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A
COURSE
OF
Anatomico-Physiological
LECTURES
ON THE
HUMAN STRUCTURE
AND
ANIMAL OECONOMY;

Interspersed with
Various Critical NOTES, extracted from Memoirs, Transactions of Learned SOCIETIES, &c. and Pathological Observations deduced from the Dissection of morbid Bodies.

INCLUDING
Whatever is most valuable in the WORKS of all the eminent PROFESSORS on these Subjects.

PARTICULARLY
WINSLOW, HALLER, RUYSCH, MORGAGNI, MONRO, HEISTER.

Illustrated with
An HISTORICAL COMPENDIUM of the Rise, Progress, and Discoveries, which have been made in the ANIMAL OECONOMY, gradually traced to the present Time.

To which are prefixed,
TWO ESSAYS on the ARTS of Dissecting, Injecting and Making ANATOMICAL PREPARATIONS.

VOL. I.

Omne tulit punctum, qui miscuit utile dulci. HOR.

By CHARLES NICHOLAS JENTY, M.A.
Professor of ANATOMY and SURGERY.

LONDON,
Printed for JAMES RIVINGTON and JAMES FLETCHER, at the Oxford Theatre in Pater-Noster-Row. MDCCLVII.

Now publiſhed by the ſame AUTHOR,

Dedicated to the Worſhipful Company of SURGEONS,

AN

Anatomical Demonſtration

OF THE

HUMAN STRUCTURE,

In four TABLES half as large as NATURE.

From the PICTURES painted after Diſſections, for that Purpoſe,

By Mr. VAN RIEMSDYK.

Diſpoſed in ſuch a Manner, as to repreſent gradually all the diſtinct Parts of the Human Body in their Natural Situation, as they appear in DISSECTION, with all the Capital Nerves, Veins, and Arteries, when injected; ſo contrived as to convey a clearer Idea of the ANIMAL OECONOMY than has yet appeared in any other Anatomical Figures.

As it may, perhaps, be imagined by ſome, that it is impoſſible to expreſs all the different Parts of the Human Structure, in theſe *Four Tables*; to obviate this Objection, it muſt be obſerved, that all the uſeleſs and perplexing Repetitions, uſually met with in Figures of this Kind, are entirely avoided.

The TABLES are done in the Mezzotinto, being the beſt Means to imitate Nature, when coloured.

N. B. Theſe PICTURES have been laid before the ROYAL SOCIETY, by whom they were looked upon as the moſt accurate of the Kind that ever appeared.

To the Right Honourable the

Earl of MACCLESFIELD,

PRESIDENT,

AND TO THE

COUNCIL

AND

MEMBERS

OF THE

ROYAL SOCIETY of LONDON,

THIS

Courſe of Anatomico-Phyſiological Lectures on the Human Structure and Animal Oeconomy is humbly dedicated by their

most obedient, and moſt

humble Servant,

LONDON,
June 30, 1757.

Charles Nicholas Jenty.

PREFACE.

I Think it will not be improper to give a concise Account of the following Lectures, and my Motives for publishing them.

I am not insensible that such a Task as this might have been executed much better by Men of superior Abilities, but it seems their Occupations either in teaching Anatomy, Practice, &c. engross so much of their Time, that they have no Leisure for it; and as they have long publickly declared and wished that some Gentleman or other would take upon him the Pains to form a System of Anatomy interspersed with Physiological and Pathological Observations adapted to the Improvements that have been made of late in the Knowledge of the animal Oeconomy.

And tho' these Subjects have been learnedly treated of separately by various Authors, but not disposed in so instructive a Manner as one could have wished, for the Benefit of TYROS.

On these Considerations, after having perused many Authors in order to form these Lectures,

 however,

however, following no Authors but ſuch only as were moſt agreeable to Nature, amongſt whom, I found none that had given a more exact Account of the human Structure and animal Oeconomy than the Profeſſors WINSLOW, HALLER, MORGAGNUS, ALBINUS, &c. I freely confeſs what Knowledge I have of the human Body is in a great Meaſure owing to the Lectures or Writings of the above Gentlemen, corroborated by the Diſſection of a conſiderable Number of human Subjects.

WINSLOW's Anatomy has been looked upon by the learned World as the moſt accurate hitherto publiſhed, altho' ſome Anatomiſts endeavour to point out Miſtakes in his Works which I believe no judicious Man can really attribute to his Ignorance of the Parts; for I may venture to ſay no Man before him has taken more Pains and made more Proficiency in the animal Oeconomy than he has.

It is true that in ſome Parts of his Work he gives a very minute Deſcription of the human Structure, (which perhaps might appear uſeleſs to many,) and ſometimes is too conciſe; he alſo uſes Repetitions which may be very uſeful in refreſhing the Memory in a publick Courſe of Lectures, but not ſo agreeable in Reading.

As the Baſis of this Work is partly founded on his Writings, and thoſe of the learned and ingenious Profeſſor HALLER, whoſe Works being ſo well known, need not any Encomium, having been always eſteemed the beſt

2 Col-

Collection of Phyfiological Effays that ever has been publifhed, tho' diffufed, in fuch a Manner, that fome might have been bafe enough, to publifh them for their own Productions. At the End of each Lecture, I add Pathological and Anatomical Obfervations adapted to it; having alfo inferted various Opinions as were thought the moft plaufible, in former Times, nay fome even now fubfifting on the moft obfcure Subjects in the animal Oeconomy, which now are exploded to prevent Beginners from falling into the fame Error; various critical Notes are difperfed in thefe Lectures, in fome of which perhaps I may have omitted the Authors Names (particularly the ingenious MONRO, on the Bones in Vol. I.) as it is not always poffible for a Man to remember exactly from whom he has taken his Obfervations. I would therefore defire the Reader not to think that I did this with an Intention of exhibiting them as my own, but attribute them to the right Owner; and if, in the Courfe of this Work, any Obfervations fhould occur, which have not been made by any Author, (that they may not go without a Name) I am willing they fhould be attributed to me.

I have been as careful as poffible not to lay down any Thing as a Principle, which to me feemed doubtful, or had not proper Authority or Experiments to fupport it. I have chofen rather to follow the Opinions of the above learned Profeffors, than to introduce any Innovations of my own, which are not duly fupported by Experience.

In the Hiſtorical Compendium there are no Authors inſerted, but ſuch have, or at leaſt endeavoured to make farther Diſcoveries in the animal Oeconomy; and I hope the ſhort Account of their Works and Editions (ſo far as they came to my Knowledge) and the ſynopſical Expoſition of the Human Structure, being an Eſſay on the Art of Diſſecting, with that of Injection and making Anatomical Preparations, will not be unacceptable to Beginners.

In the Courſe of this Work, the Reader will find that I have been at the Pains of peruſing above two hundred Authors with various Memoirs and Tranſactions of learned Societies. *In hoc gaudeo aliquid diſcere, ut doceam.* SENECA. With Regard to the Uſefulneſs of Anatomy, it is ſo univerſally known, that it will be of very little Signification, to pretend to ſay any Thing about it, except I ſhould take upon me to write a Panegyrick on the Subject.

Wherefore the only Means to obtain the Knowledge of the animal Mechaniſm, that I know of, and univerſally acknowledged to be by diſſecting and making Experiments on various Creatures, tho' I would recommend Gentlemen by all Means not to meddle with any other Subjects than Human ones, till they have attained a competent Knowledge of our own Species, not as commonly practiſed; that is, Gentlemen think when they have attended a Courſe of Lectures, and diſſected a Subject or two, they have completed their anatomical Studies, but this Proceeding is a mere Illu-

Illuſion; therefore I ſhall take the Liberty to lay down the Method which I follow; that is, when a Gentleman enters with me, firſt of all I give a compendious Theory of the Parts, without detaining him too long on the Bones as is commonly practiſed, and ſhow him how to diſſect not ſuffering him to remove any Parts till I have fully explained them, and he has acquired a competent Knowledge of the ſame; for it is well known that it is not by the Number of Subjects a Gentleman diſſects, that he attains the true Knowledge of the Structure, but by the Care and judicious Inſtructions he receives of the Parts as they lie in their natural Situation, and removing them afterwards for farther Examination ſo on gradually to the Bones, and always pay Regard to the dry Skeleton for the better underſtanding how the Parts are fixed, and give Motion to our Machine.

Likewiſe the common Method of teaching the ſanguiferous Veſſels and the Nerves on too ſmall a Subject, eſpecially the former; I think is no further uſeful, than to give a general Idea of their Diſtribution; but as theſe Veſſels are conſiderably ſmaller than in Adults, and as Chirurgical Operations are not ſo frequently performed upon Children than on grown Perſons, methinks (and I know it by Experience) that Gentlemen often commit great Miſtakes in Practice, from the Idea they have retained, of the Smalneſs of the Veſſels in Children in Compariſon with thoſe of an Adult.

I have contrived a Syringe with proper Pipes in ſuch a Manner, that a Gentleman may himſelf, without further Aſſiſtance, inject all the capital Arteries of an adult Subject at once.

Tho' I have been reading Engliſh Authors for theſe dozen Years paſt, and underſtand the Language ſufficiently to come at the Senſe, nevertheleſs I am conſcious that theſe Lectures are not ſo well penned, as if they came from an Engliſh Hand; but I muſt crave the Privileges which are allowed to Men who write on any Art or Science in a foreign Language, that is, that the Intention, not the Style, of the Writer be regarded.

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*** Among the Errors of the Preſs, which pervert the Senſe.

VOL. I.

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HISTORICAL COMPENDIUM

OF THE

Origin, Progreſs, *and* Diſcoveries,

That have been made in

ANATOMY *and* PHYSIOLOGY,

FROM

The earlieſt Time this Art was firſt cultivated, gradually to our preſent Age.

WITH Reſpect to the Antiquity of ANATOMY, it ſeems ſcarcely poſſible but that the Slaughter of Beaſts for the Uſe of Man, Caſualties, Murders, and the Accidents of War, muſt have furniſhed Mankind with a general Knowledge of the Structure of the Parts in very early Ages of the World; but it is not very certain, at what Period it began to be cultivated as a Science.

This, however, muſt have been very early, eſpecially if we pay any Regard to MANETHO, the famous Egyptian Writer; who, according to the

Report of EUSEBIUS, relates, That ATHOTIS, an Egyptian King, wrote ſome Treatiſes of Anatomy. This King, if the Egyptian Chronology was to be depended on, lived many Ages before ADAM. This, how ever falſe, with Reſpect to Time, amounts to a Sort of Proof of the Antiquity of the Science I am ſpeaking of.

It is very certain, that before, or at leaſt in, the Days of HOMER, Anatomy was much cultivated; ſince this Author appears to have had a competent Knowledge of the Parts, and to have been very well ſkilled in the Renunciation of Wounds, as the Moderns call it, ſo as to be able to give an accurate Account of their Effects, in almoſt all Parts of the Body.

But HIPPOCRATES is the firſt Author, at leaſt extant, who has treated of Anatomy ſcientifically.

This Divine Writer, conſcious of his noble and exalted Genius, publiſhed many anatomical Obſervations, which, tho' incongruous and ſcattered here and there in his Works, yet make up an entire Body of Anatomy, when taken together. But that he made it his principal Study to underſtand and explain the Bones of the human Body, is plain, from thoſe valuable and well-wrote Books upon Fractures and the Joints, which evidently diſcover his perfect Knowledge of, and intimate Acquaintance with, the Bones; and, that his Diligence, Induſtry, and Skill, in this Way, might the more effectually be tranſmitted to future Ages, he conſecrated (if we may believe PAUSANIAS) a brazen Skeleton to the Delphian APOLLO.

The Writings of this great Man are interſperſed with many Things relating to the Blood; which, as they ſeem to ſhew his Knowledge of its Circulation, and alſo of the Secretions of the Humours, Dr. DOUGLAS has pointed out ſuch of them as ſeem

ſeem to be the moſt convincing and unexception-able Proofs of this Point.

It cannot be doubted but HIPPOCRATES and the Antients knew that the Blood circulated; but it is certain they did not know how, or in what Manner, the Circulation was performed.

LE CLERC is far from thinking, with Dr. DOUGLAS, that all the anatomical Obſervations, diſperſed in the Works of HIPPOCRATES, amount to an entire Syſtem. He ſays, that it is no eaſy Taſk to give a juſt Extract of the Anatomy of HIPPOCRATES. Three Things concur to deprive us of the Light that were to be deſired in this Point. In the firſt Place, there are ſeveral Contradictions in what HIPPOCRATES has wrote upon this Subject, or, rather, in the Books aſcribed to him as their Author. Secondly, Tho' one ſhould collect all that he has ſaid concerning each Part, yet ſtill it would amount to nothing complete or coherent. In fine, though ſo many Faults had not crept into the Text, or though there were leſs Variety in the original Manuſcripts; yet his Style is ſo conciſe, and ſome Paſſages in him are ſo obſcure, and conceived in Terms ſo peculiar to himſelf, that it is not always eaſy, even for the greateſt Maſters of the Greek Language, to comprehend his Meaning.

For theſe Reaſons, one might juſtly lament the Loſs of a Book wrote by GALEN on the Anatomy of HIPPOCRATES, were not this Author to be ſuſpected, on Account of his Partiality, with Regard to that antient Phyſician: Inſtances of which, even in Point of Anatomy, are to be met with.

The Aſſiſtance which, upon this Occaſion, one might expect from Tranſlators and modern Commentators, is alſo very inconſiderable: If any Light is to be got from them, we ought to depend leſs upon theſe of the preſent, than thoſe of pre-

 ceding

ceding Ages; ſince it is to be feared, that the former, full of their new Diſcoveries, imagine they ſee them every-where; falling into the like ridiculous Error with thoſe who find in HOMER the moſt exquiſite Delicacies, and refined Improvements, of all the Arts and Sciences; or into the ſtill more unaccountable Enthuſiaſm of others, who find the Philoſophers Stone in all the Books of the Antients, whatever the Subject handled ſhould happen to be.

DEMETRIUS was cotemporary with HIPPOCRATES: With Reſpect to his Knowledge of Anatomy, we learn no more, than that, when the People of Abdera called HIPPOCRATES to cure him of a ſuppoſed Madneſs, this Phyſician found him diſſecting Animals, in order to diſcover the Cauſe of Diſeaſes, which, he apprehended, had its Reſidence in the Bile: Upon which, HIPPOCRATES reported, to thoſe who employed him, that DEMOCRITUS was not only in his Senſes, but was the wiſeſt of Men.

DIOGENES LAERTIUS gives the Title of a Book wrote by DEMOCRITUS, which ſhould ſeem to be anatomical, as it is of the Nature of Man, or of the Fleſh.

PYTHAGORAS, according to the Report of the ſame DIOGENES LAERTIUS, had ſome crude Notions of Anatomy, which are not of Importance enough to relate, ſince they are drawn from Speculation, more than Reality.

EMPEDOCLES, a Pupil of PYTHAGORAS, as we learn from GALEN, had ſome very ſingular Notions of the Structure and Uſes of the Parts of Animals: For he imagined, that certain particular Parts of their Bodies were contained in the Seed of the Male, and others in that of the Female; and that, from this Circumſtance, the venereal Deſires of both Sexes were to be accounted for:

Fooliſhly

Fooliſhly imagining, that the Parts, thus ſeparated, had a natural Tendency to join, and be again united with, each other. With Regard to Reſpiration, he thought it was performed in this Manner: " As ſoon, ſays he, as that Humidity, " of which there is great Store on the firſt Form-" ation of the Fœtus, begins to be diminiſhed, " the Air, inſinuating itſelf thro' the Pores of the " Body, ſucceeds it; after that, the natural Heat, " by its Tendency to make its Eſcape, drives the " Air out; and, when this natural Heat enters the " Body again, the Air follows it afreſh. The " former of theſe Actions is called Inſpiration, and " the latter Expiration." The Fœtus, according to this Philoſopher, reſpired in the Uterus.

The Senſe of Hearing was, according to him, excited by the Air ſtriking on the internal Side of the Ear, which is wreathed in Form of a Shell, and fixed to the moſt elevated Part of the Body, as it were like a ſmall Bell, which was ſenſible of all the Undulations and Impulſes of the Air which ſhould enter it.

The Fleſh was, according to him, compoſed of an equal Portion of the four Elements; the Nerves conſiſted of Fire, Earth, and two Parts of Water; the Nails were formed by the Extremities of the Nerves, cooled and hardened by their Contact with the ambient Air: The Bones appeared to him to be compoſed of equal Parts of Water and Earth; or at leaſt he thought that theſe two Elements predominated over the other two in their Compoſition: Sweat and Tears he took to be Blood attenuated, and rendered thin.

The Seeds of Plants he eſteemed analogous to the Eggs of Animals, which drop at the Time of their Maturity.

Alcmæon, of Crotona, who was alſo a Diſciple of Pythagoras, deſerves to have his Name

handed down to future Ages, if (as CHALCIDIUS, in his Commentaries upon the Timæus of PLATO, aſſures us,) he was the firſt who diſſected Animals, in order to know the Parts of which their Bodies conſiſt: But, Time having robbed us of his Writings, we know no more of his Anatomy than what we find in ſome antient Authors; and even what we meet with in them ſeems rather to relate to Phyſiology, than Anatomy. He imagined, that the Senſe of Hearing was occaſioned by the Ear's being concave within; and that all hollow Places reſound when any Sound entered them; and that Goats breathed partly by their Ears.

With Regard to the Senſe of Smelling, he maintained, that the Soul, of which the principal Part is, according to him, lodged in the Brain, received the Odours drawn in, in Reſpiration. He imagined, that the Tongue diſtinguiſhed Taſtes by its Humidity, moderate Heat, and Softneſs; he thought the Seed was a Part of the Brain, and that the Fœtus was nouriſhed in the Womb by drawing a Supply at all the Parts of the Body, which is externally porous like a Sponge.

Health, in his Opinion, depends on the Equality of Heat and Drineſs, Coldneſs and Humidity, and even of Sweetneſs and Bitterneſs, and other ſenſible Qualities. Maladies, on the other Hand, he thought aroſe when one of theſe Qualities predominated, and, by that means, broke the Union and Connexion.

That ARISTOTLE applied himſelf diligently to anatomical Studies, is ſufficiently plain, from his Writings; for they abundantly convince us, that he does not relate every Thing on the Authority of others, but that he was an immediate Spectator of them; though, in his Days, Diſſections of the human Body were very rare and uncommon. It muſt, however, be owned, that he borrowed many

many Things from HIPPOCRATES, which will not fail to appear, upon comparing the two Authors together: But HIERON MERCURIALIS affirms, without Reaſon, that he borrowed all his Sentiments on Anatomy from others.

ALEXANDER THE GREAT, whoſe Preceptor ARISTOTLE was, being deſirous to know the Nature and different Properties of Animals, ordered him to bend his Thoughts that Way; and, for that Purpoſe, furniſhed him with Eight Hundred Talents, which amount to about a Hundred and Fifty-five Thouſand Pounds Sterling: That Prince ſupplied him alſo with ſeveral Thouſands of Men from the different Quarters of Greece and Aſia, who had Orders to obey him, to communicate to him all they had learned from Hunting and Fiſhing, and even to nouriſh and bring up all Sorts of Animals, with no other View but to diſcover the Peculiarities of each Species, and communicate them to him.

One might juſtly think, that, with ſo conſiderable Aſſiſtances, ARISTOTLE ſhould not have failed to produce ſomething very exact and accurate upon this Subject; and yet even the Antients obſerved, that he had advanced ſeveral Things contrary to Truth.

He may be excuſed in this Point, by ſaying, that, in this Caſe, he was obliged to rely on the Authority of others, ſince he could not poſſibly ſee and do every Thing himſelf. But ſuppoſe he had been obliged, on ſome Occaſions, to rely on the Relations and Accounts of Men; for Inſtance, in what relates to certain Properties of Animals diſcovered by Chance; yet there are other Occaſions, on which he muſt have been an Operator himſelf, or, at leaſt, muſt have been preſent, and given Directions to others. Of this Kind are the Things relating to Anatomy. What Opinion,

then, muſt we have of the Accuracy of this Philoſopher, when we find him maintaining, that all Animals have their Necks flexible, and conſiſting of Vertebræ, except Wolves and Lions, whoſe Necks, he ſays, conſiſt of one Bone? What Notion ſhall we alſo entertain of him, when he aſſures us, that the Bones of Lions contain no Marrow? A Thing contrary to all the Experiments which have hitherto been made.

The Curious may conſult the learned Borichius, with regard to the other Errors into which Aristotle has fallen in reſpect of the Anatomy of the Lion, Eagle, and Crocodile: However, he has had Errors laid to his Charge, which he never was guilty of.

He looked upon the Heart as the Source and Principle of the Veins and Blood. "The Blood, "ſays he, paſſes from the Heart into the Veins;" but he ſays, that it comes from no Part to the Heart. He moreover maintained, that two Veins proceeded from the Heart; one from the right Side, which is the larger; the other from the left, which is leſſer, and which he called the Aorta.

It is proper to obſerve here, that this Philoſopher, according to Galen*, was the firſt who gave this Name to the great Artery; which proves that Hippocrates's fourth Book De Corde, where this Word is found, was not wrote by him.

He thought that theſe two Veins conveyed the Blood to all the Parts of the Body; he alſo imagined, that there were three Cavities in the Heart, which he calls Ventricles. Of theſe three, that in the Middle, the preciſe Situation of which he does not determine, is, according to him, the common Principle of all the reſt, though it be the

* De Venar. & Arteriar. Diſſect.

ſmalleſt;

ſmalleſt; the Blood, which it contains, is alſo the moſt temperate, and pure: The Blood of the right Ventricle is warmeſt, that of the left coldeſt; and this laſt is the largeſt of the three. They all have a Communication with the Lungs by Veſſels which are quite different from the two great Veins already mentioned, which Veſſels diſtribute themſelves through all the Subſtance of the Lungs.

This Philoſopher not only made the Veins or Blood Veſſels, but alſo the Nerves, to derive their Origin from the Heart; and he founded his Opinion upon this, that the largeſt of the Ventricles of the Heart contains ſmall Nerves: The Vein which he calls the Aorta is nervous, and itſelf like a true Nerve towards its Extremities, ſince it has no Cavity, and is ſtretched out in the ſame Manner with Nerves, where it terminates near the Articulations of the Bones.

He alſo maintains, that there are Numbers of Nerves in the Heart, and they are of ſingular Uſe there, ſince its Contraction and Dilatation depend upon them: But he ſeems, in this laſt Paſſage, to mean the Tendons or Fibres which contract and dilate the Heart. And if Hippocrates confounded the Nerves with the Tendons and Ligaments; it does not appear that Aristotle diſtinguiſhed theſe Parts better, nor that he knew the Uſe of the real Nerves. For he maintains, that the Nerves are not continued like the Veins; but that they are ſcattered here and there, and diſtributed to the Parts where the Articulations are: By which it is plain, that he ſtill means the Tendons. If he had underſtood the Uſe of the Nerves, he had never aſſerted, in another Paſſage, that no Parts, but ſuch as contain Blood, were capable of Senſation: And he would never have maintained, as he does, that the Fleſh is the proper Organ of Senſation. As for Motion, if he aſcribes

aſcribes it to the Nerves, it is evident, that the Nerves he means are alſo Tendons or Ligaments.

The common Principle of Motion and Senſation is, according to ARISTOTLE, lodged in the Heart, which he alſo makes to be the Principle of Nouriſhment to the whole Body, by the Blood which it ſends to all its Parts. It contains the natural Fire, is the Seat of the Paſſions, the Point, as it were, in which all the Senſations terminate, as in a common Center, and the true Seat of the Soul; and all this, not becauſe the Nerves draw their Origin from it, as one might be induced to think, by what has been ſaid; but becauſe the Heart is the Reſervoir, or Storehouſe, of the Blood and Spirits.

ARISTOTLE even maintains, in plain Terms, that the Spirits cannot be contained in the Nerves.

But if he aſcribed ſuch noble Uſes to the Heart, he imagined, that the Brain was only a Maſs of Earth and Water, void of Blood, and deſtitute of Senſation. "The Office of this cold Maſs was, "ſays he, to balance and correct the Heat of the "Heart:" But, beſides his aſcribing this Office elſewhere to the Lungs, he does not ſpecify the Manner in which he imagined the Brain could anſwer this End. Though the Brain be placed immediately above the Medulla Spinalis, and is joined with it; yet ARISTOTLE imagined, that this Marrow was quite a different Subſtance from that of the Brain, being only a Species of Blood prepared for the Nouriſhment of the Bones; and, conſequently, hot: Whereas the Brain was, in his Opinion, very cold. Beſides, he thought the Brain of ſo little Importance, as to place it only next in Rank to the Excrements; and imagined, that it ought not to be ranked among the Parts of the Body, which are united and connected with one another: But that it ought to be looked upon as a Sub-

Subſtance of a particular Nature, quite different from all the reſt of the Parts.

With Regard to the other Viſcera, ſuch as the Liver, Spleen, and Kidneys; he imagined, that their principal Uſe was, to ſupport the Veins, which, without them, would be looſe and pendent, and to fix them in their proper Places. Beſides this general Uſe, he aſſigned a particular one to each of them. The Liver, for Inſtance, aſſiſts the Concoction of the Aliment in the Stomach and Inteſtines, by the Heat which it communicates to theſe Parts: The Spleen is not of ſo great Uſe; it is only, in our Philoſopher's Opinion, accidentally neceſſary to collect, prepare, and give a different Direction to the humid Vapours which riſe from the Belly: And hence thoſe Animals, in which theſe Vapours take a different Courſe, have only very ſmall Spleens. Of this Claſs are Fowls and Fiſhes, whoſe Feathers and Scales are nouriſhed by this Humidity; "and for this very Reaſon, ſays he, theſe Animals have neither Kidney nor Bladder." The Kidneys alſo are, according to him, only deſigned for a Piece of Convenience; ſince their Office is, to imbibe a Part of the Excrement which is carried to the Bladders of thoſe Animals in which it abounds too much, that the Bladder may be eaſed of Part of its Burden. He adds, a little after, that the Humours filtrate themſelves, or flow through the Subſtance of the Kidneys; in which, indeed, he has come ſomewhat nearer to the Uſe generally aſcribed to theſe Parts: But he talks, at the ſame Time, very obſcurely on the Point.

The Teſticles are alſo, according to him, Parts formed by Nature for Convenience; but are not abſolutely neceſſary. He alſo affirmed, that two Veins came from the Aorta, and were inſerted into the Teſticles; and that two other Veins came to them

them from the Kidneys; and that theſe latter Veins contained Blood, but the former none: That there came from the Head of each Teſticle, or at leaſt from ſome one of its Extremities, another larger and more nervous Canal, which bending itſelf, and leſſening by Degrees, aſcends to the two others; and, being wrapped up in a Membrane, terminates at the Root of the Penis. He adds, that this laſt Canal contains no Blood, but a white Liquor; and that, terminating at the Penis, or towards the Neck of the Bladder, it there finds an Aperture which leads to the Penis; about which Opening, there is a kind of Huſk, or Bark.

Taking this for granted, he maintained, that, when the Teſticles were cut from any Animal, all the abovementioned Canals ſhrivelled up; and that it was for this Reaſon, that caſtrated Animals could not, for the future, propagate their Species. For a Proof of this, he produces an Inſtance of a Cow, which conceived after Copulation with a Bull immediately after his Caſtration, and before the ſeminal Veſſels were ſhrivelled up.

In another Paſſage he explains himſelf ſtill more particularly, with Regard to the Uſe of the Teſticles, when he maintains, that they are no Part of the Canals or Reſervoirs of the Seed; and that they have nothing in common with them; but that they only ſerve as a Counterpoiſe to draw them downwards, and to retard the Motion of the Seed, almoſt in the ſame Manner with thoſe Stones which Weavers tie to their Webs. He advanced farther, as a Proof of the Uſeleſſneſs of the Teſticles, with Regard to Generation, the Inſtances of Fiſhes and Serpents; which being, to all Appearance, deprived of theſe Parts, did, nevertheleſs, propagate their Species.

He alſo thought that Conception was occaſioned by a Mixture of the male Seed with the menſtrual

Blood

Blood in the Matrix; and aſcribed no other Part in Generation to the female Seed, which, according to him, was only the Excrement of the Matrix, which ſome Females diſcharged, and ſome not; and that theſe laſt were not, on that Account, leſs fit for Generation, or more deprived of the Senſation of venereal Enjoyments, ſince it proceeded from the Afflux of Spirits to the Parts of Generation.

As to the Place where the Concoction of the Aliments was performed, and the Manner in which it was brought about, he imagined, that the Aliments were firſt prepared in the Mouths of ſuch Animals as uſed any kind of Food which ſtood in Need of Maſtication. But we muſt not imagine, that, in that Place, any Sort of Concoction is made; the Food is only reduced into ſmall Parts, that it may the more eaſily be prepared and penetrated, after it has deſcended into the Stomach, which are both deſigned for the Preparation of the Aliments: And as the Mouth is the Opening at which the unprepared Aliments enter, and the Oeſophagus the Duct by which it is conveyed to the Stomach; there muſt, in like manner, be other Openings, by means of which all the Parts of the Body receive the Degrees of Nouriſhment which they ſtand in Need of. Theſe laſt Openings are the meſenteric Veins which draw what is neceſſary for them from the Stomach and Inteſtines, in the ſame Manner as Horſes draw Hay from a Rack.

Aristotle imagined alſo, that as Plants received their Nouriſhment from their Roots, which were ſpread in the Earth; ſo Animals received theirs by the meſenteric Veins, which may be compared to ſo many Roots deſigned for drawing the Juice from the Stomach and Inteſtines; theſe laſt Parts being, with regard to Animals, what the Earth is in reſpect of Plants.

I muſt alſo obſerve, with regard to the Anatomy of ARISTOTLE, that he himſelf never diſſected any Thing but Beaſts; and that, in his Days, they had not ventured on the Diſſection of human Subjects. This he himſelf ſeems to inſinuate, when he ſays, that the internal Parts of Man's Body are unknown, or that we have nothing certain relating to them; but that we muſt judge of them by the Reſemblance they bear to thoſe of other Animals which correſpond to them.

By theſe Sketches of the Anatomy of ARISTOTLE, we may form a Judgment of his Knowledge in this Science; and conclude, that he knew very little, or nothing, of the true Uſes of the Parts. It muſt, however, be remarked, that he mentions the Inteſtinum Jejunum; and diſtinguiſhes the Colon, Cæcum, and Rectum; whereas HIPPOCRATES only takes Notice of the Colon and Rectum*.

DIOCLES CARYSTIUS is ſaid to have lived ſome little Time after ARISTOTLE, that is, under the Reign of ANTIGONUS. GALEN informs us, that he was the firſt who wrote upon the Method of diſſecting Bodies; this Art, before his Days, being confined to private Families, and only taught to the Children and Pupils of thoſe who poſſeſſed the Secret. But the ſame Author tells us, that DIOCLES made no great Advances in Anatomy.

But much greater Progreſſes were made, in this Science, by HEROPHILUS and ERASISTRATUS. The former is ſaid to have lived during the Reign of PTOLEMY SOTER, and to have been born at Carthage.

* LE CLERC gives ſome more Particulars relating to the Anatomy of ARISTOTLE, which may be conſulted by the Curious; but it will give no great Information to Anatomiſts of our Days.

They

They are reported to have had this in common, that both of them diſſected living Subjects. Of the former TERTULLIAN talks in this Manner: "HEROPHILUS, that Phyſician, or rather Butcher, "who diſſected ſix hundred Men, in order to find "out Nature; who hated Man, in order to know "the Conſtruction of his Body; could not, by "that means, come to a more perfect Knowledge "of his internal Parts, ſince Death induces a great "Change on all the Parts, as they are not the "ſame after Death as they were before; eſpecially "ſince they did not die a natural Death, but under "all the Agonies to which the Curioſity of the "Anatomiſt was pleaſed to ſubject them."

The Fact may poſſibly be true; the Poſſibility of it is not to be diſputed, ſince, in theſe Days, we meet with Inſtances of the like Inhumanity. But may we not ſuſpect, that, ſince theſe two Perſons were the firſt who diſſected human Bodies, the Novelty of the Attempt forcibly ſtruck the Minds of the Vulgar, and laid a Foundation for groundleſs Exaggerations, and a Publication of more than was real Truth? a Thing very common, upon Occaſions of the like Nature.

Witneſs the Story of MEDEA, who was branded with the Inhumanity of boiling Men alive, for no other Reaſon, but becauſe ſhe invented warm Baths. And who, to this Day, can perſuade the Vulgar, but the Pupils of anatomical Schools ſecretly convey People in order to diſſect them?

It is, however, certain, that HEROPHILUS and ERASISTRATUS had really diſſected many human Bodies. The laſt of theſe ſpeaks, in a Fragment of his anatomical Works, of the Brain of a Man whom he had diſſected; and GALEN * talks of the

* De Diſſect. Vulvæ, Cap. v.

firſt

firſt of theſe two Men in this Manner: "He was, "ſays he, an accompliſhed Man, in all the Branches "of Phyſic; but he was particularly knowing in "Anatomy; which he had learned, not by the "Diſſection of Beaſts alone, as Phyſicians uſually "do, but, principally, by that of Men."

GALEN alſo obſerves*, that it was at Alexandria, the Capital of Egypt, where HEROPHILUS made his Diſſections; which makes it probable, that it was owing to the Curioſity of the Kings, and their Inclination to encourage the Arts, that theſe two Phyſicians had the Liberty granted them of inſtructing themſelves by diſſecting human Bodies; a Liberty which thoſe of ſucceeding Times very rarely enjoyed for many Ages, whether thro' a Defect of Kings of equal Courage and Learning with the firſt PTOLEMIES, or thro' the ſcrupulous Diſpoſition of the People paſſing to the Sovereigns, or getting the better of their Authority. I am not ignorant that RIOLANUS has maintained, in Oppoſition to this, that they not only diſſected Men before his Time, but that this Practice was even continued down to the Days of GALEN. He alſo maintained, that ARISTOTLE practiſed the ſame kind of Diſſection; but this learned Anatomiſt proves no more than that ARISTOTLE really diſſected Animals, and compoſed ſome Books of Anatomy, to which he often refers his Readers. This cannot be denied; but that he diſſected Men, cannot be proved; ſince we find ARISTOTLE himſelf confeſſing, that he never diſſected any Thing but Beaſts.

This Anatomiſt ſucceeds no better, when he attempts to prove that HIPPOCRATES had diſſected human Bodies; but his Arguments for this will,

* Adminiſtrat. Anatomic. Lib. VII. Cap. 5.

upon

upon an impartial Review, be found ſo weak and inconcluſive, that we may ſafely infer, that Herophilus and Erasistratus were the firſt who were known to diſſect human Bodies. As for the former of them, one of the principal Proofs of his Accuracy is this; that he addicted himſelf to thoſe Parts of Anatomy which had not before been touched upon.

Neurology, or the Diſſection of the Nerves, was, in his Days, a Part of Anatomy, not, as yet, well known. Galen informs us, that Herophilus was the firſt, after Hippocrates, who handled this Matter with Accuracy; but he ſhares the Praiſe, due to him in this Reſpect, with another Phyſician, Eudemus.

As for Hippocrates, who likewiſe comes into the Account upon this Occaſion, Galen, being reſolved to extol him above all the antient Phyſicians, honours him with a Degree of Knowledge, in this Reſpect, which his Writings nowhere diſcover.

It is very probable, that Herophilus was the firſt who was known to diſcover the Nerves, properly ſo called, and who knew how to demonſtrate them. According to Rufus Ephesius, he divided the Nerves into three Kinds. The firſt he called 'Αισθητικὰ καὶ προαιρετικὰ νεῦρα, or thoſe Nerves which are the immediate Inſtruments of Senſation, and the Miniſters of the Will: Theſe, according to him, derived their Origin from the Brain, from which they roſe like ſo many Branches, and were a Part of the Medulla Spinalis. The ſecond proceeded from ſome of the Bones, and terminated at others of them. The third aroſe from ſome of the Muſcles, and terminated at others. By this we ſee, that Herophilus gave the Name of Nerves to thoſe Parts, which were afterwards called Liga-

ments and Tendons. But it is a Matter of little Moment what Names Things receive, provided they be ſufficiently diſtinguiſhed.

In reality, this Diſtinction of three Sorts of Nerves, aſcribed to this antient Anatomiſt, is a Proof that no ſuch Diſtinction was made before his Time, and that theſe Parts were confounded with one another.

The Writings of HEROPHILUS being loſt, we know no more of his Sentiments, with regard to the true Nerves, but that he gave the Name of Optic Pores to thoſe Nerves which reach to the Bottom of the Eye, and which now are called Optic Nerves; and maintained, that they had a ſenſible Cavity, which was not to be met with in other Nerves.

There is nothing remarkable, with reſpect to his Notions of the Uſes of the Brain, except that we are told, that he imagined the reaſonable Soul was lodged in its Ventricles.

But one of his principal Diſcoveries, which tho' looked upon to be the Product of our own Age, is nevertheleſs very antient, is, his finding certain Veins in the Meſentery, which, according to him, were deſtined to nouriſh the Inteſtines, which do not, like the other Veins, go to the Venæ Portæ, but terminate in certain glandular Bodies. ERASISTRATUS likewiſe diſcovered ſomething of this Nature, which now are called the lacteal Veins.

Beſides, as HEROPHILUS had learned Anatomy, not by reading the Books of his Predeceſſors only, and formed particular Ideas of the Parts from what he had ſeen in Diſſections, eſpecially thoſe of human Bodies; he expreſſed theſe Ideas by Words which appeared to him moſt proper for that Purpoſe; that is, he invented new Names, and gave Names to Parts which before had none.

For

For inſtance; he called the firſt of the Inteſtines, or that which is next to the Stomach, Δωδεκαδάκτυλον, becauſe it is twelve Inches in Length*.

Having alſo obſerved, that the Veſſel which paſſes from the right Ventricle of the Heart to the Lungs, and which he took for a Vein, had a thick Coat like that of an Artery; he called it, if we may believe RUFUS EPHESIUS, the arterial Vein; and, for a quite contrary Reaſon, he called the Veſſel which comes from the Lungs to the left Ventricle of the Heart, the venous Artery. But though the Names he gave to thoſe Veſſels point out the Knowledge he had of the Heart, and the Veſſels with which it is immediately connected, yet GALEN obſerves†, that he has been very negligent in deſcribing the Membranes of the Heart, to which he had, nevertheleſs, given a Name; calling them nervous Separations, or Partitions.

It was alſo HEROPHILUS who firſt called two Tunics of the Eye the Tunica Retina, and the Tunica Arachnoïdes: He alſo called that Membrane which lines the Ventricles of the Brain, the Membrana Choroïdes, becauſe he ſaw that it reſembled the Chorion which covers the Fœtus in the Matrix.

He alſo compared the Cavity which forms the fourth Ventricle of the Brain, Ἀναγλυφὴ τοῦ καλάμου, to the Concavity of a writing Pen, or Reed, uſed for that Purpoſe in Egypt. He has, in like manner, given the Name of Ληνὸς, Torcular, to that Place where all the Sinuſes of the Dura Mater unite.

* The Moderns need not cavil, as the Antients uſed to meaſure Inches by the Extremities of their Fingers.

† De HIPPOCRAT. & PLATON. Decret. Lib. I. Cap. 10.

It was he likewiſe who gave the Name of Glandulæ Paraſtatæ to thoſe Glands which lie about the Root of the Penis.

He ſtiled theſe Paraſtatæ glandulous, in order to diſtinguiſh them from other Paraſtatæ, which he called varicoſe, and which he placed at the Extremity of thoſe Veſſels which convey the Seed from the Teſticles; or rather, as he thought, which ſerve to prepare it. For though he did not deny that the Teſticles ſerved, in ſome meaſure, to the Generation of Seed; yet he thought, that the abovementioned Veſſels contributed much to that Purpoſe.

The Word Paraſtata imports any Thing ſituated near another. Some antient Phyſicians have alſo given the ſame Name to the Epididymis.

It is plain, that HIPPOCRATES and ARISTOTLE knew the varicoſe Paraſtatæ of HEROPHILUS, though they did not give them the ſame Name.

The Authority of HEROPHILUS, in Point of Anatomy, was ſo great, that almoſt all the Names he aſſigned to the different Parts are ſtill preſerved. The Teſtimony of Antiquity is ſo ſtrong, in Favour of him, that we cannot, without injuring his Character, deny him to have been the beſt Anatomiſt of his Time. If his Writings had reached our Hands, we might have been able to have judged of his Sentiments for ourſelves; but as they are loſt, we can ſay no more, than that what is preſerved in Quotations is ſufficient to give us a great Idea of his Exactneſs and Skill, eſpecially if we conſider that he lived at a Time when Anatomy was only in its Infancy, and that his whole Stock of Knowledge, in this Particular, was principally of his own acquiring.

FALLOPIUS, a knowing Anatomiſt of the laſt Age, was ſo ſuperſtitious an Admirer of HEROPHILUS,

PHILUS, that he laid it down as a Maxim, that it was as unreaſonable to contradict him, in Point of Anatomy, as to contradict the Goſpel: But the Encomium was too extravagant.

It is generally thought, that ERASISTRATUS was contemporary with HEROPHILUS, or lived very ſoon after him.

It was by means of Anatomy that this Phyſician firſt became conſiderable in the World; and GALEN, who, upon many Occaſions, talks unfavourably of him, yet confeſſes, that ERASISTRATUS had contributed a great deal to the Re-eſtabliſhment of Anatomy, which, as he ſays, had been, in a great meaſure, loſt for ſome Time before: But it is no eaſy Matter to find out what particular Period of Time he has in View. However, that we may underſtand the Paſſage the better, it is neceſſary to relate the Whole of it. "Thoſe, ſays he, who are not aſhamed to ſpeak "againſt Evidence, are the Cauſe of the Length "of this Diſpute" (the Diſpute betwixt him and CHRYSIPPUS the Stoic, who maintained, that the Seat of the Soul, and the Origin of the Nerves, was in the Heart). We ought not to accuſe either HIPPOCRATES, EUDEMUS, HEROPHILUS, or MARINUS, who, ſince the Days of the Antients, have re-eſtabliſhed the Science of Anatomy, which had been neglected, ἐν τῷ μεταξὺ χρόνῳ, in the intermediate Space of Time between them.

GALEN, at firſt, ſeems to hint at the Time which paſſed between ESCULAPIUS, or his firſt Deſcendants, and HIPPOCRATES; which is that dark Period, during which the State of Phyſic was not known: But we ſhall ſee, by what he ſays elſewhere, that he meant no ſuch Thing. In order, then, to prevent the Contradiction between the Paſſage now quoted and ſome others of the ſame Author, we muſt neceſſarily put a Point after

the Word HIPPOCRATES, and begin another Period, thus: "We ought not to lay the Blame "upon HIPPOCRATES, neither ought we to ac-"cuſe ERASISTRATUS, EUDEMUS, HEROPHI-"LUS, nor MARINUS; who, after the Antients "have re-eſtabliſhed the Science of Anatomy, "which had been neglected in the Time inter-"vening between them." Or this Sentence of GALEN may be tranſlated thus: "We ought nei-"ther to accuſe HIPPOCRATES, nor thoſe who "have re-eſtabliſhed Anatomy, which had been "neglected in the Interval between them and him, "ſuch as ERASISTRATUS, EUDEMUS, HERO-"PHILUS, &c." According to this Explication, which is the genuine Senſe of GALEN, HIPPOCRATES will not be ranked among the Reſtorers of Anatomy, which would not agree with what the ſame Author ſays in another Paſſage*: "That "the antient Phyſicians, and even the antient Phi-"loſophers, were very much addicted to the Study "of Anatomy; and that, in thoſe Days, Fathers "not only trained up their Children in it, by ob-"liging them to read and write upon the Subject, "but alſo, by making them diſſect Subjects them-"ſelves: So that, having learned the Thing from "their Infancy, it was impoſſible they ſhould for-"get it. But, continues he, it was not ſo after-"wards, when Phyſic came to be out of the "Hands of the ASCLYPIADEAN Family, and when "Phyſicians began to teach their Art to Strangers, "eſpecially to Men advanced in Years, for whom "they had an Eſteem, and whom they reverenced "on account of their Virtue. Theſe Men, not "being young enough to labour at Anatomy with "Succeſs themſelves, or to inform themſelves of

* De Adminiſtr. Anatom. Lib. II. Cap. I.

"the

"the Parts of the Body by their own Sight, and "by putting their Hands to the Work, could "only learn Anatomy very imperfectly. Hence "it was, that, in Proceſs of Time, the neceſſary "Inſtructions, in this Branch of Learning, paſſing "often from one Hand to another, Anatomy grew "ſtill worſe and worſe."

Thus GALEN ſuppoſes that Anatomy was in a flouriſhing State whilſt Phyſic was confined to the ASCLYPIADEAN Family; he even fixes, in expreſs Terms, the Beginning of its Declenſion, at the particular Time when Phyſic began to be practiſed by others, than thoſe of that Family.

Now we are no-where informed that Phyſic was practiſed out of this Family till the Philoſophers began to encroach upon the Art, or, at leaſt, till HIPPOCRATES began to teach Diſciples, as GAEEN elſewhere obſerves. As this is the Caſe, it is ſcarce to be believed that the Philoſophers were the Cauſe of the Decay of Anatomy, ſince it was their Intereſt to carry it to its Perfection, even tho' they had not had the Intereſt of Phyſic in View.

GALEN himſelf does not think that this was the Caſe; ſince he joins the Philoſophers and Phyſicians together, when he ſpeaks of the Time wherein Anatomy was in its Perfection; and by the Philoſophers, he undoubtedly meant DEMOCRITUS, and others who preceded HIPPOCRATES. So that the Time ſpoke of muſt be that which followed the Death of HIPPOCRATES.

But there is a conſiderable Difficulty in this Point: For if HIPPOCRATES was ſo ſkilful an Anatomiſt as GALEN repreſents him, who can poſſibly believe that his Knowledge, in this Particular, ſhould have been ſo ſoon loſt, or raſed from the Memories of Men, that DIOCLES, PRAXAGORAS, and the other Phyſicians of their Time,

were ſo little improved by his Diſcoveries, or the Traditions of them, that GALEN has*, with Juſtice, ſtiled them unſkilful Anatomiſts? Before this could happen, a conſiderable Time muſt have intervened between HIPPOCRATES and theſe Phyſicians; but where ſhall we find all theſe Succeſſions, or that great Number of Generations, ſince all the Authors agree, that DIOCLES followed not long after HIPPOCRATES; ſo that he muſt have been contemporary with PLATO? As this is the Caſe, if he did not ſee HIPPOCRATES himſelf, he muſt, at leaſt, have ſeen his Sons, or his Sons-in-law, who may reaſonably be preſumed to inherit the Knowledge of their Father, in Point of Anatomy, as well as of the other Branches of Phyſic. And as for PRAXAGORAS, who lived almoſt in the ſame Time with DIOCLES, tho' he had not had an Opportunity of inſtructing himſelf in the ſame Way, that is, by the Traditions of HIPPOCRATES and his Diſciples; yet, according to GALEN himſelf, he was one of the Deſcendants of ESCULAPIUS, the Children of whoſe Family were trained up to Anatomy from their Infancy: So that, in this Reſpect, HIPPOCRATES could enjoy no greater Advantages than he. GALEN would not have involved himſelf in this Difficulty, if he had not been unreaſonably prepoſſeſſed in Favour of the ASCLYPIADEAN Family, as may be eaſily ſeen by his Works.

It is certain, that before ERASISTRATUS and HEROPHILUS, carried Anatomy to a higher Pitch of Perfection; but GALEN, who looked upon the former of theſe as the Rival of HIPPOCRATES, was unwilling to confeſs this; but declares, all along, in Favour of the latter.

* De Diſſect. Vulvæ, Cap. 9.

It is alſo certain, that, before ERASISTRATUS and HEROPHILUS, Anatomiſts had never ventured to diſſect human Bodies; and that, in the Time of ARISTOTLE, who lived not long before theſe two Phyſicians, they had only diſſected Beaſts.

It muſt be owned, that, in Egypt, they had, long before, a Cuſtom of embalming their dead Bodies, which could not be done without opening them; and GALEN himſelf confeſſes, that this Cuſtom might have furniſhed the Phyſicians of that Country with a favourable Opportunity of inſtructing themſelves: But as it is not probable that thoſe Perſons, who were employed in embalming, durſt ſatisfy their Curioſity entirely, and ſearch as narrowly as was neceſſary into the human Body, which was looked upon as ſomething ſacred; Anatomy could not poſſibly arrive at any conſiderable Pitch of Perfection, whilſt no other Means were employed in its Cultivation: Carcaſſes, upon which every Thing might be attempted, were abſolutely neceſſary for that Purpoſe. Theſe were, probably, firſt granted in Conſequence of the Inclination which the Kings of theſe Times had to advance the Arts and Sciences.

ALEXANDER THE GREAT firſt began to patronize thoſe who applied themſelves to natural Hiſtory, by ordering ARISTOTLE to labour at that of Animals, and their ſeveral Parts; and, without doubt, PTOLEMY SOTER, or PTOLEMY the Son of LAGUS, ſucceeded ALEXANDER, as well with regard to this Inclination, as to that Part of his Empire which fell to his Share. This appears ſtill the more probable, if we conſider, that PTOLEMY was a Man of Learning, and wrote, himſelf, a Hiſtory of ALEXANDER, as we learn from ARRIAN. PTOLEMY PHILADELPHUS, Son of the preceding PTOLEMY, was no leſs induſtrious in promoting Arts and Sciences; ſince he invited to his

his Capital all the learned Men of his Time; and collected, at an extraordinary Expence, a Library of Books from all Parts of the World, in order to form a Library; which was ſtill augmented by his Succeſſors.

It is probable, that theſe two Kings, getting over the Scruple which had till then reigned, of diſſecting human Bodies, not only granted the Phyſicians the Bodies of Criminals after their Death; but, if we may give Credit to ſome Authors, put into their Hands many of theſe wretched Creatures to be diſſected; imagining that they might, by that means, diſcover Things which otherwiſe they could not do. "HEROPHILUS "and ERASISTRATUS, ſays CELSUS, have diſ-"ſected living Criminals, condemned to Death, "and dragged from their Priſons, by the Order of "their Kings, for that very Purpoſe."

Which ſoever of theſe two Princes ERASISTRATUS lived under, it is probable, that he laid hold of this favourable Opportunity, and made thoſe Diſcoveries in Anatomy which gained him ſo high a Reputation. But as his Writings have not reached us, we know no more of his Sentiments than what are tranſmitted to us by GALEN, who generally quotes him with no other View but to refute him.

The principal of ERASISTRATUS's Diſcoveries, which, by the way, was not made upon human Bodies, but which, at the ſame Time, acquired him abundance of Honour, was, his finding out * certain white Veſſels in the Meſentery of ſucking Kids, which he believed to be Arteries. He added, that theſe Veſſels ſeemed at firſt to be full of Air, and afterwards Chyle.

* GALEN. an Sanguis ſit Natura in Arteriis, Cap. 5. & Adminiſtrat. Anatom. Lib. VII. Cap. ult.

ERA-

Erasistratus and Herophilus were the firſt who knew the true and genuine Uſe of the Brain and Nerves, or, at leaſt, the Uſes aſcribed to them by all ſucceeding Anatomiſts. Rufus Ephesius ſays, that Erasistratus owned two Sorts of Nerves; thoſe which are the Inſtruments of Senſation, and thoſe that are the Inſtruments of Motion. He maintained, according to Galen, that the former were hollow, and drew their Origin from the Membranes of the Brain; whereas the other ſprung from the Brain itſelf, and the Cerebellum. But Galen informs us*, that Erasistratus having enquired more accurately into the Matter, was at laſt convinced, that all the Nerves proceed equally from the Brain. This may be gathered from a Paſſage of this antient Anatomiſt, related by Galen, the whole of which I ſhall tranſlate, that we may ſee what Notions he entertained with reſpect to the Brain, Cerebellum, Nerves, and all the ſeveral Parts connected with each of them.

" We examined, ſays Erasistratus, what
" the Nature of the human Brain was; and we
" found it divided into two Parts, as it is in all
" other Animals. It had a Ventricle, or Cavity,
" of a longitudinal Form (here there ſeems to be
" a Chaſm, or Defect, in the Text): Theſe Ven-
" tricles had a Communication with one another,
" and terminated in a common Opening, accord-
" ing to the Contiguity of their Parts, reaching
" afterwards to the Cerebellum, where there was
" alſo a ſmall Cavity; but each Part was ſepa-
" rated from the other, and ſhut up in its proper
" Membranes; and the Cerebellum, in particular,
" was wrapped up by itſelf, as well as the Brain,

* De Hippocrat. Platon. Decret. Lib. vii. Cap. 3.

" which,

" which, by its various Windings and Turnings, " reſembled the Inteſtinum Jejunum. The Cere- " bellum was, in like manner, folded and twiſted " different Ways, ſo that it was eaſy to know, by " ſeeing it, that, as in the Legs of ſwift running " Animals, ſuch as the Hart, Hare, and ſome " others, we obſerve Tendons and Muſcles well " calculated for that Purpoſe; ſo in Man, who " has a larger Share of Underſtanding than other " Animals, this great Variety and Multiplicity of " Foldings in the human Brain was, undoubtedly, " deſigned for ſome particular End. Beſides, we " obſerved, continues ERASISTRATUS, all the " Apophyſes or Productions of the Nerves which " come from the Brain: So that, to ſay all at " once, the Brain is viſibly the Principle of every " Thing that paſſes in the Body; for the Senſe of " Smelling proceeds from the Noſtrils, being " pierced, in order to have a Communication with " the Nerves. The Senſe of Hearing is alſo " produced by the like Communication of the " Nerves with the Ears. The Tongue and the " Eyes receive alſo the Productions of the Nerves " of the Brain."

Here we ſee, by the Confeſſion of ERASISTRATUS himſelf, that he had diſſected Men. He had alſo very accurately deſcribed, in GALEN's Opinion*, the Membranes which are found at the Orifices of the Heart; and he maintained, with ARISTOTLE, that the Veins and Arteries drew their Origin from it. "There are, ſays he, certain " Membranes inſerted in the Orifices of the Veſ- " ſels of the Heart, of which the Heart makes " Uſe, either for the Reception or Expulſion of " ſuch Subſtances as either enter into it, or come

* De HIPPOCRAT. & PLATON. Decret. Lib. I. Cap. 10. & Lib. VI. Cap. 6.

" out

" out of it. Some, adds GALEN, have been ſo " raſh as to deny that there were ſuch Mem- " branes, and have looked upon them as Fictions " of ERASISTRATUS, or a kind of Hypotheſis in- " vented to ſupport his own Syſtem: But theſe " Membranes are ſo well known by Anatomiſts, " that none but Novices in the Art are ignorant " of them. There are, continues GALEN, three " of theſe Membranes at the Orifice of the Vena " Cava, which reſemble the Points of Arrows; " whence ſome of the Diſciples of ERASISTRATUS " have called them Τριγλῶχινες, Tricuſpides. There " are alſo, at the Orifice of the Arteria Venoſa (for " ſo I call the Artery which, riſing from the left " Ventricle, diſperſes itſelf in the Lungs), Mem- " branes of a like Form, but of different Names; " for that Orifice has only two Membranes. The " other two Orifices, I mean that of the Vena Ar- " terioſa, and that of the Arteria Magna, have " alſo each of them three Membranes, reſembling " the Sigma of the Greeks, which reſembled our " C."

Here GALEN, ceaſing himſelf to ſpeak, again introduces ERASISTRATUS; ſaying, that " Theſe " two laſt Orifices are equally diſpoſed to convey " any Thing from the Heart; that through the " former the Blood flows to the Lungs, and thro' " the latter the Spirits, in order to be diſtributed " thro' the whole Body." (Here ſome Part of the Greek Text ſeems to be wanting.) " Thus " it happens, continues ERASISTRATUS, that theſe " Membranes alternately perform oppoſite Offices " to the Heart. Thoſe which are adherent to the " Veſſels by which Subſtances are carried into the " Heart, bend inwards, that they may yield to the " Impetuoſity of ſuch Things as are carried to- " wards them, and, lying in the very Cavities of " the Heart, may open its Entry for the Intro-

" duction

" duction of ſuch Subſtances as are attracted to it: " For we have no Reaſon to imagine that ſuch " Subſtances enter the Heart of their own Accord, " as if it were an inanimate Receptacle; but the " Heart, by its Diaſtole or Dilatation, draws them " to it, as the Blackſmith's Bellows does the Air; " and in this Manner the Heart is filled. The " Membranes of thoſe Veſſels, on the other Hand, " which ſerve to convey Things from the Heart, " are quite differently diſpoſed and ſituated; ſo " that, yielding eaſily to the Subſtances coming " from the Heart, they open their Orifices, at the " Time it thruſts out ſuch Subſtances; whereas, " at other Times, they ſhut up theſe Orifices, and " allow nothing to return which is once thruſt out; " juſt as the Membranes of the Veſſels, which " ſerve to introduce Things into the Heart, ſhut " the Orifices of theſe Veſſels, upon the Heart's " contracting itſelf, and allow nothing to be car- " ried out, which is once thrown in."

It were to be wiſhed, that GALEN had left us more Fragments of ERASISTRATUS, of the ſame Nature with theſe two.

Beſides, what he elſewhere ſays, that ſome thought the Membranes of the Heart a Fiction of ERASISTRATUS, is a ſure Proof that the Book De Corde, aſcribed to HIPPOCRATES, was not really wrote by him; ſince in it theſe Membranes are made mention of. If this Book had been wrote by the Author whoſe Name it bears, GALEN would not have failed to take Notice of it, for his Honour, and in order to ſtop the Mouths of thoſe who thought that theſe Membranes were an Invention of ERASISTRATUS. He had nothing to do but to let theſe People ſee, that HIPPOCRATES had wrote before on the ſame Subject.

But it is ſurpriſing that this ſame ERASISTRATUS, who had ſo accurately examined the Heart,

and diſſected ſo many living Animals, ſhould yet embrace an Opinion, with regard to the Arteries, which all other Anatomiſts have looked upon as abſurd. He affirmed, as did PRAXAGORAS before him*, that, in a natural State, the Arteries contained no Blood; and that they, as well as the left Ventricle of the Heart, were only filled with Air. It was an eaſy Matter to give him the Teſtimony of his own Eyes for his Error; but he had Recourſe to this Subterfuge†. "As ſoon, ſaid "he, as we open the left Ventricle of the Heart, "that Air or Spirit is evaporated before we can "obſerve it, and the Ventricle is inſtantly filled "with Blood." He aſſerted the ſame Thing with regard to the Arteries.

What engaged him to entertain this Opinion, with regard to the Arteries, was, as GALEN informs us, becauſe he could not conceive how there ſhould be two Kinds of Veſſels deſtined for the Conveyance of the ſame Liquor; that is, why both the Veins and Arteries ſhould contain and convey the Blood. If he had known the Secret of the Blood's Circulation, which ſome learned Men imagine is plainly found in the Writings of HIPPOCRATES, he had not been ſo much puzzled and perplexed with regard to this Point: He might even have informed himſelf of it by the Knowledge he had of the Membranes or Valves of the Heart, if he had not been miſtaken with regard to one of them. What follows will illuſtrate this Anatomiſt's Opinion, and, at the ſame Time, inform us, what his Sentiments were, with regard to the Cauſes of Diſeaſes.

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* GALEN. an Sanguis ſit Natura in Arteriis.

† Ibid. & PLATON. Decret. Lib. I. Cap. 6. & De Veneſect. adv. ERASISTRAT. Cap. 3.

GALEN ſays*, that ERASISTRATUS maintained, "That the great Vein was the Reſervoir of the "Blood, and the great Artery that of the Spi-"rits." He added, "That, after theſe Reſer-"voirs had divided themſelves into many Branches, "they became ſmaller, and their Number greater; "and that as there is no Place in all the Body, "where any of theſe Branches terminate, that has "not a ſmaller Branch which receives what was "brought to it by the larger; ſo it happens, that, "before theſe Veſſels arrive at the Surface of the "Body, they divide themſelves into Branches ſo "ſmall and minute, that the Blood they contain "cannot paſs thro' them: So that, adds our Au-"thor, tho' the Mouths of the Arteries and Veins "be very near each other, yet the Blood keeps "itſelf within its proper Bounds, without enter-"ing the Veſſels in which the Spirits flow; and, "in this Caſe, the Animal remains in its natural "State: But when any violent Cauſe happens to "diſturb this Oeconomy, the Blood forces itſelf "into the Arteries, and proves the Source of "Diſorders. Among the Cauſes now mentioned, "too great a Quantity of Blood is the principal; "for, in that Caſe, the Coats of the Veins are di-"lated more than ordinarily, and their Extre-"mities, which were formerly ſhut up, are opened; "whence follows a Transfuſion of Blood from "the Veins into the Arteries; and this Blood, by "its Irruption, oppoſing the Courſe and Motion "of the Spirits which come from the Heart, if "this Oppoſition is direct and immediate, or if "the Blood ſtops in a principal Part, this cauſes "a Fever; but if the Spirits ſhould happen to "drive it backwards, ſo that it does not paſs the

* De Veneſect. adverſ. ERASISTRAT.

"Ex-

" Extremity of the Artery, in that Caſe, an In-
" flammation of the Part is only produced. As to
" the Inflammation and Fever which happen in
" Wounds, they are alſo occaſioned by the ſudden
" Evacuation of Spirits, which is the Conſequence
" of the Cutting of the Artery, and forces the
" Blood continually into the Place of the Spirits,
" leaſt there ſhould be a Vacuum."

ERASISTRATUS made uſe of this Compariſon to ſupport his Syſtem *. As the Sea, ſays he, which remains in a Calm, when ſhe is not ruffled by Winds, ſwells in an extraordinary Manner, and overflows her Shores, when the Wind blows hard; ſo the Blood moving in the Body, departs from its ordinary Canals, and enters into the Reſervoirs of the Spirits, where it afterwards becomes warm, and puts all the Body, as it were, on a Fire.

Theſe are the Notions which ERASISTRATUS entertained with regard to the Cauſes of Diſeaſes in general, which at the ſame time are very different, from thoſe attributed to him; by the Author of a Treatiſe aſcribed to GALEN, intituled the INTRODUCTION; who aſſures us, that this Phyſician did not ſearch for the Cauſes of Diſeaſes in the Humours, or the Spirits, but in the ſolid Parts; whereas HIPPOCRATES looked upon theſe three Subſtances, as the Cauſes of Health and Diſeaſes. I think that Author only means that ERASISTRATUS did not admit of the different Humours mentioned by HIPPOCRATES, or at leaſt ſeemed to think them of ſo little Importance, as not to aſcribe the Cauſes of Diſeaſes to them. This is what GALEN himſelf confirms; but he aſſerts at the ſame time, that though ERASISTRATUS over-

* GALEN. Hiſt. Philoſoph. PLUTARCH. CELS.

looked and neglected the Humours, he was neverthelefs obliged to fpeak of them on fome Occafions, as for Inftance *, when he fays, that a Palfy proceeds from the Humour, which nourifhes the Nerves, being ftopped on Account of its too great Vifcidity, and when he talks of the Bile and black Urine.

With regard to Refpiration †, he maintained, that it was only ufeful to Animals by filling their Arteries with Air, which is a Confequence of his former Hypothefis; and he imagined that the thing was done in this Manner: When the Thorax ‡ or Breaft dilates itfelf, the Lungs are alfo dilated, and filled with Air. This Air paffes to the very Extremities of the Afpera Arteria; and from them to thofe of the fmooth Arteries of the Lungs, from which the Heart draws it when it dilates itfelf, to carry it afterwards through all the Parts of the Body, by means of the great Artery.

When it was objected to him, that the Heart moved in its ordinary Manner, when a Perfon retains his Breath, he anfwered, That, upon that Occafion, the Heart drew Air from the great Artery. To this, it was replied, that the Membranes which adhere to the Orifice of this Artery, will not fo much as allow it to return from it to the Heart. But he thought to extricate himfelf by faying, That though this was the Cafe in a Natural State, yet it did not follow, that it muft be fo during the Time a Perfon retains his Breath, which is a State of Violence, and confequently cannot laft very long.

Erasistratus alfo entertained a very fingular Opinion, with regard to the Manner in which the Aliments were prepared in the Stomach. He thought, that the Stomach contracts itfelf, that it may more clofely embrace the Food, and break

* De Atra Bile. † Galen. de ufu Refpirat. Cap. 1. ‡ Galen. de ufu Refpirat. & de Locis affect.

its

its Texture; that Trituration correſponding, according to him, to the Concoction of which HIPPOCRATES ſpeaks. And with regard to the Chyle, that is the Juice of the Aliments extracted in the Stomach, he maintained *, that paſſing from the Stomach to the Liver, it arrived at a certain Place, where the Branches of the Vena Cava, and the Extremities of the Veſſels, which are connected with the Reſervoirs of the Bile, equally terminate; ſo that the Parts of the Bile inſinuate themſelves into the Orifices of theſe two Kinds of Veſſels, according as theſe Orifices are diſpoſed to receive them; that is, every thing of a bilious Quality in the Chyle, paſſes into the Canals connected with the Reſervoir of the Bile, and the pure Blood paſſes into the Vena Cava, and taking another Courſe, is ſeparated from the Bile. GALEN † makes ERASISTRATUS ſay, that the Veins are divided in the Liver for the Separation of the Bile.

Beſides we muſt obſerve ‡ that neither ERASISTRICATUS, nor his Succeſſors, pretended to account for the Cauſes of certain Effects; Reſearches of which Kind they thought belonged more properly to the Philoſophers than to the Phyſicians. Tho' they believed, for Inſtance, that the Stomach contracts itſelf for the embracing the Food the more cloſely, yet they were not at the Pains to enter into minute Explications of the particular Cauſes and Manner of this Contraction. Neither did they heſitate to own, that they were uncertain whether the Bile was produced in the Body, or if it was before contained in the Aliment.

Another Proof of the Ingenuity of ERASISTRATUS, we have in AULIUS GELLIUS ||, who in-

* GALEN. de Facult. Natur. Lib. II. Cap. 9. † De uſu Part. Lib. IV. Cap. 13. ‡ GALEN de Facult. Natur. Lib. II. & de Atra Bile, Cap 5. || Lib. XVI. Cap. 3.

forms us, that he frankly owned, when talking of unſatiable Hunger, or a Boulimia, (a Word not to be found in HIPPOCRATES, but which all the Greek Phyſicians after him have made uſe of) that he did not know why the Diſeaſe happened rather during great Cold, than in hot Weather; though he imagined, that Hunger, in general, proceeded from the Stomach and Inteſtines being empty; and that a long and unpainful Abſtinence was owing to the Stomach's being ſtrongly contracted and ſhrivelled up. It was for this Reaſon, added he, that thoſe who faſt voluntarily feel Hunger towards the Beginning of their Courſe, but not after they have faſted for ſome Time. He brought in ſupport of his Opinion, the Example of the Scythians *, who, when they were obliged to faſt, ſwaddled themſelves up with large Rowlers, with a View to contract or ſtrengthen their Stomachs.

ERASISTRATUS owned, that the Urine was ſeparated in the Kidneys, but he did not acknowledge, with HIPPOCRATES, that it was done by Attraction; for he entirely rejected this ſort of Attraction, though he no where explains himſelf with regard to the Manner, in which this Separation is made. Some of his firſt Followers believed, as GALEN informs us, that the Parts above the Kidneys received only pure Blood; that what is aqueous, or charged with Seroſities, tends downward by its own Weight; and that after this Blood is ſeparated from the aqueous, an uſeleſs Part, it is carried to the Parts above the Reigns to nouriſh them.

It is neceſſary alſo to obſerve, that ERASISTRATUS rectified PLATO with regard to the Uſe of the Arteria Trachea, through which PLATO imagined

* GALEN. de Natural. Facultat. Lib. 1. Cap. ult.

the

the Drink was carried, in order to water the Lungs *. This Opinion was common to PLATO, with PHILISTION, HIPPOCRATES, and moſt of the Phyſicians of thoſe Days. LYCUS and QUINTUS are alſo mentioned as two ancient Anatomiſts, but nothing particular is known of their Diſcoveries.

MARINUS is alſo mentioned, as an Author who wrote well on the Anatomy of the Muſcles; after the Time of ERASISTRATUS, GALEN is ſaid to have epitomized his Works.

AURELIUS CORNELIUS CELSUS is alſo an Author of too diſtinguiſhed Merit to be paſſed over in Silence. He was born at Rome, and in all Probability, flouriſhed under TIBERIUS, CALIGULA, CLAUDIUS, and NERO. Many things are found diſperſed in his Writings, from which we may gather, that he rarely employed himſelf in Diſſections; but that he had, at the ſame time, a very high Veneration for Anatomy.

Beſides his Books De Re Medica, he alſo wrote concerning the Figure and Situation of all the Bones of the human Body, which, indeed, is the principal Reaſon why he ſhould not be overlooked, upon an Occaſion of this Nature.

His Sentiments, with reſpect to Anatomy, are ſpecified in the beginning of this Narrative.

CAIUS PLINIUS SECUNDUS was, according to ſome, born in Novocomum; others will have him to be a Native of Verona; but however this be, it is certain, that he lived under the Emperor VESPATIAN, about the Year 72. His Writings are interſperſed with many curious Obſervations, relating both to the Anatomy of Men, and other Animals; but as he was no profeſſed Anatomiſt, and never appears to have been exerciſed in Diſec-

* See AULUS GELLIUS, PLUTARCH, and MACROBIUS.

tions, he took, and inſerted in his Works, Truth and Fiction indiſcriminately, as he met with them in the Writings of others.

Dr. Wigan, as well as all Authors, who have mentioned the incomparable Aretæus, have been ſenſible of the Difficulty of fixing the Time in which he lived, but concludes it probable, that he wrote after the Beginning of Nero's Reign, and before that of Domitian. His Taſte may be judged from this, that he thought a Knowledge of Anatomy ſo neceſſary, both for diſcovering the true Cauſes of Diſeaſes, and the proper Methods of Cure, that in the Beginning of almoſt every Chapter he premiſes ſomething concerning the Structure of the Part affected. In this Inſtance he ſeems to have purſued the Steps of Erasistratus and Herophilus, who were the Chiefs of the dogmatic Sect, and maintained, that without a Knowledge of Anatomy, no one could poſſibly be a ſkilful Phyſician. So that Aretæus, though a conciſe and compendious Writer, has yet inſiſted upon this Branch of Medicine more copiouſly, and with more Accuracy than any of the antient Phyſicians.

The Heart is, according to him, the Principle of Life and Strength, in which the Soul and Nature of Man, reſide in a particular Manner. This was alſo the Doctrine of Hippocrates and Chrysippus the Stoic. For this Reaſon, a Syncope, as it is a Diſeaſe of the Heart, and conſequently muſt have an immediate Influence upon Life, is unfriendly to the human Conſtitution, and in ſome Meaſure deſolves and deſtroys that Connection, by which the vital Faculty is maintained. He alſo aſſerted, that the Heart was a warm Part of the Body, and the Principle of Life and Reſpiration; that it is ſituated in the Middle of the Lungs; and that the Heart inſpires the Lungs with a Deſire of freſh Air, as it heated the Lungs, but that the Heart itſelf attracts it.

The

The Lungs were, according to him, naturally incapable of Pain, becauſe they conſiſted of a looſe Sort of Subſtance reſembling Wool. He alſo maintained, that rough cartilaginous Arteries, incapable of Pain, were diſtributed through them, and that they had no Muſcles, but only ſome ſmall and ſlender Nerves, by means of which their Motion was produced. And this, according to him, was the true Reaſon why in a Peripneumony, which is no more than an Inflammation of the Lungs, the Lungs themſelves are inſenſible of Pain; and only a ſort of Heavineſs at the Breaſt, which is nevertheleſs free from Pain, afflicts the Patient; but that all thoſe Membranes, by which the Lungs are connected to the Breaſt, are endowed with a moſt exquiſite Senſation; and if they are inflamed, together with the Lungs, the Patient is pained as in the Caſe of a Pleuriſy accompanied with a Peripneumony.

This, according to him, is alſo the Reaſon why in Spitting of Blood, where the Blood, being immediately diſcharged from the Lungs, creates the moſt dangerous of all Diſorders, the Patients never ceaſe to hope, even in the very laſt Stages of the Diſorder, becauſe the Lungs themſelves are inſenſible of Pain; for under every trifling Degree of Pain, the Patients become afraid of Death, and moſt People are more frightened for the Conſequences, than hurt by the Diſeaſe itſelf; whereas in the moſt terrible Diſorders, when unaccompanied with Pain, the Patient is not racked with the Fears of Death; and indeed this Diſtemper is more fatal than frightful to the Patient.

The Pulſation of the Arteries, according to him, propelled the Blood; for which Reaſon, if the Arteries are wounded, the Lips of the Wound are with Difficulty brought together, and kept in Contract. The Arteria Craſſa, or the Aorta, which

runs near the Vena Cava, in the ſame Direction with the Spina Dorſi, and by ARETÆUS, after PRAXAGORAS, called Ἀρτερία παχεῖη, ſuffers Inflammation along with the Vena Cava, which Inflammation was by the Ancients called a Species of Cauſus, ſince in both, the ſame Symptoms appear, and the Fever in the one Caſe tends to a Syncope, as well as in the other; for the Liver, is the Root of the Veins, and the Heart, the Source and Orgin of the Arteries. It is therefore probable, that the ſuperior Parts of theſe Viſcera are affected; for the Heart imparts Warmth to the Arteries, and the Liver conveys Blood to the Veins. Now ſince both theſe Viſcera are very large, the Inflammations to which they are ſubject, muſt of Courſe be very conſiderable. But this ſame Artery, in Inflammations of the Vena Cava, palpitates near the Spina Dorſi, which appears from the Pulſation in the other Part of the Præcordia; for the Artery, lying cloſe by the Vein on its left Side, is drawn into Conſent with it, as being diſperſed through the whole Body.

Thoſe of the Ancients, whoſe Writings have been handed down to us, ſcarce make any mention of the Diſorder of this Artery and Vein. But whoever has handled this Subject, has followed the Opinion of PRAXAGORAS, who, as we learn from RUFUS EPHESIUS, affirmed that the Origin of Fevers was in that Vein, which ſends Branches from the Liver to the Kidneys and which alone he called χοιλη, Cava, though others alſo gave the ſame Name to that which riſes upwards to the Heart, through the Septum Tranſverſum. So ARETÆUS likewiſe calls it and ſays, that both theſe are only a Continuation of one and the ſame Vein. The Veins riſe from the Liver, as from their common Root, and receive the Blood they contain from it. From the Porta of the Liver, betwixt

betwixt its Extremities, a large Vein ariſes, which, dividing itſelf ſtill more and more, is at laſt diſperſed through the Liver, in Veins ſo ſmall and minute, as to become inviſible.

The Extremities of theſe Veins are inſerted, into the Orifices of others, which, growing gradually larger, and fewer in Number, at laſt terminate in the Liver in one great Vein, which dividing itſelf again into two Branches, reach beyond the Liver. One of theſe Branches, penetrating the firſt Lobe of the Liver, again emerges into its gibbous Part; and having afterwards perforated the Septum Tranſverſum, extends itſelf within the Breaſt, but adheres to no other Part; and being ſuſpended there, is inſerted into the Heart; this is called the Vena Cava. Another, penetrating through the fifth and inferior Lobe of the Liver, as far as its gibbous Part, goes out near the Spina, and runs along it to the Coxæ. This is alſo the Vena Cava; for it receives the ſame Name, becauſe it is the ſame Vein ariſing alſo from the Liver: For if any one has a Mind, he may paſs a Probe from the upper Part of the Vena Cava, which reaches to the Heart, into that Part of it which creeps along the Spina, and back again from the Spina, through the Liver, into the Heart, for the Paſſage is the ſame.

In this Vein, beſides the above mentioned Inflammation, thoſe Diſorders which the Greeks called Κέδματα, ariſe; in which Caſe the Hæmorrhage conſequent upon its Rupture, ſoon puts an end to the Life of the Patient.

The Blood is conveyed from all the principal Viſcera to the hollow Vein at the Cubit; for this Vein, and that which lies above it, are Branches of one and the ſame Vein in the Arm: Hence it is of no greater Service to open the ſuperior Vein, than this; for they are entirely ignorant of the Sources

Sources of the Veins, which appropriate the ſuperior Vein to the Stomach and Liver. But if there ſhould happen any Effuſion of Blood from the Spleen, ſome Phyſicians order the Vein lying betwixt the little Finger and the ring Finger to be opened, becauſe they imagine, that it reaches to the Spleen; but this is alſo a Branch of the inferior Vein of the Cubit. Why then ſhould any one chooſe to open it ſo near the Fingers, ſince at the Beginning of the Elbow, it is much larger, and permits the Blood to flow out more readily.

The Work of Sanguification belongs to the Liver, which is the Source of the Veins; and for that Reaſon the greateſt Part of it is no more than a certain Concretion of Blood; for as the Aliments have great Acceſs to the Liver, and as there is no other way by which the Food is conveyed through the whole Body, from the Stomach and Inteſtines, ſo the Blood paſſes from this Bowel to all the Parts of the Body. This was alſo the Sentiment of ERASISTRATUS.

The Portæ Jecoris conſiſt of Nerves and Membranes, which are indeed ſmall of themſelves, but of great Importance to the Functions of Life; and of large Veins, for which Reaſon they are very ſubject to ſmall Inflammations. Beſides, ſome Philoſophers have affirmed, that the Appetites of the Soul were lodged in this Place.

Now the Bile is formed in the Liver, and is ſecreted by means of a Cyſtis or Bladder ſituated there for that Purpoſe, and afterwards is conveyed to the Inteſtines, by certain Ducts; and if they ſhould be obſtructed by a Schirrus, or an Inflammation, or if the Contents of the Bladder ſhould overflow, the Bile returns backwards, and is mixed with the Blood, which flowing through the whole Body carries likewiſe the Bile along with it. Hence in Jaundices, the Skin ſeems, as it were, tinged with Bile, and the

the Excrements are white like Clay, and untinged with the Colour of the Bile, becauſe none of that Humour flows to them. Hence alſo Icteric Patients are coſtive, becauſe their Bellies, are neither moiſtened nor ſtimulated by the Bile.

The Aliment of the Spleen is black, and the Spleen itſelf deterges and refines the black Blood. It is a Bowel of a rare Contexture, and of a diſſolvable Nature, and for this Reaſon ſubject to Impoſthumations and Abſceſſes.

The Stomach preſides over Pleaſure and Uneaſineſs, and becauſe it is adjacent to the Heart, the common Source of all the Faculties; (for it is connected to the Middle of the Heart and Lungs, and with them adheres to the Spina Dorſi) it contributes very much to Strength, and to Compoſure or Dejection of Mind upon Account of its Conſent with the Soul. This is the principal Faculty of the Stomach. From Pleaſure ariſes a good Digeſtion, a full and fleſhy Habit of Body, and a freſh and lively Colour. From Uneaſineſs the Contraries of theſe ariſe, and ſometimes Dejection of Mind, when the Stomach is empty. The Diſorders of the Stomach are properly ſpeaking, Nauſeas, Vomitings, Loathings of Food, Hiccoughs, Eructations, and theſe too ſometimes acid; and though in People labouring under Diſorders of the Stomach, it is generally free from Thirſt, yet in it the Source and Origin of Thirſt is contained.

The Colon alſo contributes to the Concoction of the Food, as well as the Stomach, and the Aliments are conveyed from it to the Liver: Neither do all the Aliments paſs through viſible Canals, for Nature diſtributes the far greater Part of them, through the whole Body by Vapours, which eaſily paſs from one Part of the Body to another; and theſe very Vapours are alſo by Nature carried through the compact and ſolid Parts of the Body. The

The Colon is a very large Inteſtine, wide enough in all its Parts, and formed into Sinuſes more thick and fleſhy than the ſmall Inteſtines, and more capable of bearing Injuries; for this Reaſon, when this Inteſtine is the Seat of Colic Pains, the Danger is the leſs: For when the ſmall Inteſtines are affected, a ſharp and pungent Pain is felt; but when the Colon is affected, there is great Abundance of Humours, and a Senſation of Gravity is perceived in it.

By Reaſon of its Situation and Connection, the Pain ſometimes reaches to the Ribs, and makes a Pleuriſy ſuſpected; for even in the Colic, a Fever ſometimes ariſes. Sometimes the Pain appears to be on one Side, ſometimes on the other, under the ſpurious Ribs; ſo that the Liver or Spleen, ſeems to be affected, and the Pain falls down again to the Ilia. With ſome this Pain ſeizes the Os Sacrum, the Thighs, and the Cremaſter Muſcles of the Teſticles; ſo that ARETÆUS, knowing the Reaſons of theſe Symptoms, juſtly ſtigmatized the Ignorance of ſome Phyſicians, who, in this Caſe, cut off the Cremaſter Muſcles, as if they had contained the immediate Cauſe of the Diſeaſe. Now can any thing advanced by later Anatomiſts, poſſibly come nearer the Truth?

There are two Tunics of the Inteſtines, as well as of the Stomach, one of which lies obliquely upon the other. When therefore the Connection of theſe is diſſolved, as it ſometimes happens in Dyſenteries, the interior Tunic, ſeparating lengthways, is diſcharged by Stool, and ſtrikes many, who are unacquainted with the true Cauſe, with a Dread of having loſt their Inteſtine; and the exterior Tunic remaining within, incarns and cicatrizes, and then the Patient becomes ſound; but the lower Inteſtine is only ſubject to this Accident, as having its Tunics of a fleſhy Nature.

The

The Kidneys are naturally glandular Bodies, of a reddiſh Colour reſembling rather the Liver, than the Breaſts and Teſticles. Theſe are Glands, but they are whiter than the Kidneys. The Kidneys indeed reſemble the Teſticles in Figure, but they are broader, more crooked, and contain ſmall Sinuſes, with narrow Necks, for percolating the Urine. From theſe, two ſmall Nervous Canals, reſembling little Pipes, branch out, which are called the Ureters, and are inſerted in the Sides of the Bladder on each Side, and from both Kidneys there is an equal Conveyance of the Urine to the Bladder. Nature has formed the Sinuſes of the Kidneys oblong, and by that Means adapted them to the Diameters of the Ureters, which are but ſmall.

The Bladder is of a very inconſiderable Thickneſs, and naturally of a nervous Texture; for which Reaſon, it neither incarns nor cicatrizes eaſily. When it is full, it is diſtended, and when empty, it collapſes; ſo that in Caſe of an Ulcer, it ſuffers juſt as much as a Joint does, in Extenſion and Contraction. Now all Ulcers upon the Joints are cured with the greateſt Difficulty. Beſides, bilious Urine and an inveterate Ulcer muſt neceſſarily corrode the Bladder.

The Anus and Bladder are contiguous to each other, and for this Reaſon, in Inflammations of the Rectum, the Bladder with Difficulty diſcharges its Contents; and in Diſorders of the Bladder, the Fæces are not diſcharged even though the Belly ſhould not happen to be coſtive.

Certain Membranes are affixed to the Ilia, which are nervous Ligaments of the Uterus; theſe Membranes, which are inſerted in the Bottom of the Uterus, hard by the Loins, are ſmall and ſlender; the others towards its Neck, and which, adhere here and there to the Ilia, are very nervous, and ſpread much after the Manner of the Sails of a Ship.

Now

Now if all theſe Membranes are relaxed, the Uterus falls out of its Place. Sometimes the interior of the two Membranes, which ſurround the Uterus appears, and may be ſeparated from the other; for only two of its Membranes can poſſibly be divided, one of which recedes from the other, by Reaſon of the Fluxion of Humours, as it happens likewiſe in Miſcarriages and hard Labours, in which Caſe it adheres to the Chorion; for if that is forcibly extracted, the Tunic of the Uterus comes along with it; but if the Woman eſcapes Death, and if it returns to its proper Situation, it reunites exactly, or elſe hangs a little out. Sometimes the Mouth of the Uterus, falls out only as far as its Neck, but it is eaſily reſtored, if Fumigations are uſed, and the Midwife uſes proper Endeavours to replace it gently, and by Degrees.

The Head is the Origin of the Senſes and Nerves, and rather attracts the Blood from the Heart, than conveys it to other Membranes.

When therefore the Cauſe of any Diſorder is lodged in the Nerves, the Senſes muſt be injured. Though the Nerves ariſe from all Parts of the Head, yet the anterior Part of the Head, is the Store-houſe as it were, of all the Senſes, and from it all Aids and Injuries are derived. For this Reaſon in applying Fomentations, we ought to proceed no farther than the Vextex.

Aretæus following the Opinion of Erasistratus, maintained, that the Nerves were not only the Origin of Senſation, but the Source of all Action and Motion of the Members. So that if the Origin of any Nerve below the Head is affected, as the Membrane or Meninx of the Medulla Spinalis, the Parts which come under the ſame Denomination, and alſo thoſe which are contiguous, become paralytic; the Parts on the right Side if that Side be hurt; and thoſe of the

the left, if the Nerves on that Side ſhould happen to be injured. But if the Cauſe of the Diſeaſe be lodged in the Head, if the Nerves on the right Side be affected, the Parts on the left Side will be paralytic, and Vice Verſa. The Reaſon of this Phænomenon is, that the Nerves change Sides near their Origin; for thoſe on the right Side do not go directly all the way to the Parts on the right Side; but both thoſe on the right and left Sides, being inſerted in their proper Origins, they immediately croſs one another in the Form of the Greek Letter X, tending to oppoſite Parts. But whether the whole Body, or ſome of its Members, either on one or both Sides, are paralytic, the Nerves which ariſe from the Head, are ſometimes affected, and in ſhort are eaſily deprived of their ſenſitive Faculty, but do not of themſelves ſo readily become incapable of Motion. Theſe Nerves alſo, if by Conſent they contract any Injury, from thoſe deſtined for the Purpoſes of Motion, loſe in ſome Meaſure their Capacity for Motion, with ſome Degree of which, though a very ſmall one, they are naturally endowed. Sometimes alſo the Nerves ariſing from ſome Muſcles, and terminating in others, are hurt; and theſe are the Nerves which are chiefly capable of Motion, and convey it to the Nerves of the Head, which derive a great deal of their Motion from them, tho' they have ſome Degrees of it in themſelves. Theſe Nerves therefore ſuffer principally a Decreaſe of Motion, but they rarely, or never loſe their ſenſitive Faculties; and if at any Time, a Congeries of Nerves ariſing from any Bone, and terminating in another, ſhould be either relaxed or broke, the Parts become impotent and contracted, but they are not deprived of Senſation.

According to ARETÆUS, a Tatanus is a Diſeaſe, incident to the Nerves, in which he alſo taught

taught, that the principal Cauſe of Melancholly reſided; he likewiſe thought, that they were affected, and often contracted in a Phrenitis; and that in the Gout all the Syſtem of Nerves was affected.

Theſe were the Notions maintained by Aretæus, with regard to Anatomy, which he made chiefly ſubſervient to Phyſic, in accounting for the Symptoms and Cauſes of Diſeaſes. In this, he imitated the Sect of Dogmatiſts, who maintained, that ſince Pains and Diſorders of various Kinds were incident to the internal Parts, no one could apply Remedies to them, who was ignorant of their Structure. So that though the Notions of Aretæus concurred ſometimes with thoſe of Hippocrates, Erasistratus, or Herophilus; yet he was not the blind Votary of any Party, or the too fond Admirer of any Man; but freely declares what he himſelf thought Truth. See Wigan's Preface to Aretæus.

Rufus Ephesius is the next anatomical Auther of Note we meet with; he lived under the Emperors Nerva and Trajan, and was eſteemed a very ſkilful Phyſician by Galen, who alſo informs us, that he wrote in Verſe upon the Materia Medica. He alſo wrote a Treatiſe upon the Atra Bilis, or black Bile, and ſome other Pieces quoted by Suidas, but theſe have not reached our Hands; for the only Remains we have of this Author, are ſeveral Parts of the human Body; another on the Diſeaſes of the Kidneys and Bladder, and a Fragment relating to purgative Medicines.

The principle Deſign of this Phyſician, in the firſt of theſe Works, was to give a general Idea of Anatomy, and to diſſuade thoſe who ſtudied Phyſic in his own Days, from being deceived in reading the antient Authors, ſome of whom had deſcribed the Parts of the human Body, under one

Set

Set of Names, and others of them, the ſame Parts, under quite different Appellations.

Beſides, we may fairly gather, from what Rufus advances in this Treatiſe, that, in his Days, all the anatomical Demonſtrations were made upon Beaſts.

" Make Choice, ſays he, of an Animal as " nearly reſembling Man as you can poſſibly " meet with."

You will not find all the Parts of the Animal exactly, and in every Particular, like thoſe of Man; but there will, at leaſt, be ſome Analogy or Similitude betwixt them. " Formerly, con- " tinues he, Anatomy was taught on human " Bodies."

We alſo learn, from the ſame Book, that thoſe Nerves, which were afterwards diſtinguiſhed by the Epithet Recurrent, were but juſt then diſcovered. " The Antients, ſays Rufus, called " the Arteries of the Neck, carotid or carotic " Arteries; which Epithet, in their Language, " implied Sleep-inducing: Becauſe they imagined, " that, when theſe Arteries were ſtrongly com- " preſſed, the Animal was inclined to Sleep, and " loſt the Uſe of its Voice." But in this Age we have diſcovered, that theſe Symptoms are not occaſioned by the Compreſſion of thoſe Arteries, but by that of the Nerves which are contiguous to them.

It is alſo probable, that Rufus obſerved certain Veſſels of the Matrix, of which preceding Anatomiſts made no mention. " Herophilus, " ſays he, did not believe that Women had any " Paraſtatæ Varicoſæ; but, upon examining the " Matrix of a Beaſt, I have obſerved certain Veſ- " ſels which ariſe from the Teſticles, and which, " being folded back upon both Sides in the Form " of Varices, terminate in the Cavity of the Ma- " trix."

“ trix.” Upon compreſſing theſe Veſſels, there even flows from them a glutinous Humour; and it is thought, that they are certainly ſeminal Veſſels of the varicoſe Kind. Rufus had before obſerved, that in Men there were four ſpermatic Veſſels, two of the varicoſe, and two of the glandular Kind; and that the Extremities of the former, which adhered to the Teſticles, were called Paraſtatæ.

What he, in this Paſſage, calls Paraſtatæ Varicoſæ, appear to be the ſame Things which are now called Tubæ Fallopianæ, from Fallopius, the ſuppoſed Diſcoverer.

Galen is the next and principal Anatomiſt of Antiquity: To him we are obliged for moſt we know, with reſpect to the Anatomy of the Antients. As a complete Extract of his Works, on this Subject, would be too voluminous, we will in this Place only give ſome general Remarks on his Anatomy.

He maintained, That the Asclypiadæ, or Deſcendants of Esculapius, down to the very Days of Hippocrates, who was one of that Race, were perfect Maſters of Anatomy; but that none of that Family, except the laſt, had wrote any Thing upon that Subject. The Reaſon of their not writing was, that their Children, to whom alone they communicated their Art, learned Anatomy immediately under themſelves, almoſt as ſoon as they learned the Letters of the Alphabet; and that by ſeeing Diſſections (ſuch as were practiſed in thoſe Days, which I think were very imperfect) made, and making them themſelves; ſo that they had no Occaſion for Books to inſtruct them in this Art.

“ It afterwards happened, ſays Galen, that “ Hippocrates, having wrote on Anatomy, as “ well as the other Branches of Phyſic, and hav-

“ ing

" ing firſt made Strangers his Diſciples, Ana-
" tomy began to decline apace; becauſe the Phy-
" ſicians who came after him ſatisfied themſelves
" with reading his Books, without taking the
" Pains to diſſect themſelves."

Diocles, who came almoſt immediately after Hippocrates, wrote alſo on the ſame Subject, but in ſuch a Manner, as diſcovered abundance of Ignorance.

Things remained in this Situation till the Death of Diocles, which happened much about the Time in which Herophilus and Erasistratus appeared.

Theſe two Phyſicians applied themſelves induſtriouſly to Diſſections; and had, for that Purpoſe, as many human Subjects as they deſired: So that they ſoon re-eſtabliſhed Anatomy, which had been neglected during the above mentioned Interval. But the Anatomiſts of ſucceeding Ages had not the ſame Opportunities of diſſecting human Bodies, the Reaſons for which are enumerated at Length by Riolan.

" Moſt human Bodies, ſays he, were burned
" immediately after Death: There was a Law
" enacted at Rome, in Conſequence of the Diſ-
" order which reigned during the Civil War that
" happened under Marius and Sylla, which
" diſcharged and prohibited the committing any
" Outrages on the Bodies of the Dead." We alſo know, that, in the Days of Antiquity, People were not only afraid of touching, but even of coming near, human Carcaſſes; and for that Reaſon the Veſpillones, or thoſe who interred the Dead, and even the Coriarii, or thoſe who prepared the Skins of Beaſts, had their Dwellings without the Gates of Rome: Nor had the public Executioners any Reſidence in it; for the Romans were ſo delicate in this Point, that they

would not ſo much as allow any one to be puniſhed within their Walls.

The Laws of the Jews, relating to thoſe who touched dead Bodies, are too well known to ſtand in Need of an Enumeration; but every one does not know that the Sentiments of the Greeks, with regard to this Point, were the ſame of thoſe with the Jews. This RIOLAN proves by a Paſſage from the IPHIGENIA of EURIPIDES.

"If any one, ſays that Poet, ſtain his Hands "by Murder; if any one touch a Carcaſs, or a "Woman immediately after Child-birth, the "Gods diſcharge him from their Altars, as im-"pious and profane."

The Difficulty which there formerly was, of finding human Bodies for Diſſection, appears from a Paſſage of PLINY (Lib. XXVIII. Cap. 2.) to the ſame Purpoſe; where he ſays, that it was againſt the Laws to look into the Entrails of Men.

But theſe Authorities, and all the others brought by RIOLAN, cannot hinder him from thinking, that, in all Ages, Phyſicians have fallen upon the Means of procuring human Bodies for Diſſection.

This he endeavours to prove by a Paſſage of PLINY (Lib. XIX. Cap. 5.), where he ſays, that the Kings of Egypt, in antient Times, opened the Bodies of the Dead, in order to know of what Diſtempers they died. The Egyptians alſo uſed to embalm their Dead, which they could not poſſibly do without opening them. There were at Alexandria * human Skeletons, by which means, young Phyſicians learned to know the Bones.

We read in RUFUS EPHESIUS, that the Phyſicians, who lived before him, had learned Anatomy upon human Bodies; and the Accounts

* GALEN. Adminiſtrat. Anatom. Lib. I. Cap. 2.

handed

handed down to us of HEROPHILUS and ERASISTRATUS, will not allow us to doubt of it. GALEN * pronounces, concerning the firſt of theſe Phyſicians, that he had acquired a very exact Knowledge of Anatomy by diſſecting Men, and not Beaſts, as moſt other Phyſicians uſed to do.

SENECA, according to RIOLAN, affirms†, that Phyſicians opened the Bowels of Men, in order to diſcover the Cauſes of their Diſeaſes; and that, even in his Time, they diſſected the ſeveral Parts of Bodies, in order to know the Situation of the Joints and Nerves. But in the common Edition of SENECA there are only theſe Words; *Medici, ut vim ignoratam Morbi cognoſcerent, Viſcera Hominum reſciderunt:* "Phyſicians, "that they might know the hidden Natures of "Diſeaſes, opened the Bowels of Men."

Now SENECA, according to RIOLAN, lived in the Days of AUGUSTUS, TIBERIUS, and NERO; and the Roman Phyſicians were allowed to diſſect the Bodies of their Enemies, which, in Reality, they did during the Wars of MARCUS AURELIUS againſt the Germans, as GALEN informs us: It was alſo no difficult Matter to procure the Bodies of ſuch as were put to Death at Rome, ſince they remained uninterred without the Eſquiline Gate, now called the Porta di S. LORENZO. The Bodies of expoſed Children might have alſo been eaſily obtained. In ſhort, ſince, in theſe Days, Maſters had great Numbers of Slaves, who could hinder them from uſing any Liberties with the Carcaſſes of theſe poor Creatures, which they themſelves ſhould judge proper?

* De Diſſect. Vulvæ, Cap. 5.

† Medicos ut vim ignoratam Morbi cognoſcerent, Viſcera reſcidiſſe; hodie Cadaverum Artus reſcindi, ut Nervorum articulorumque poſitio cognoſci poſſit.

RIOLAN might have ſubjoined to all theſe Proofs what CICERO ſays*: " We know not our " own Bodies; we are ignorant of the Situation " of the Parts, and unacquainted with the Pow- " ers of each particular Member. For this Rea- " ſon, the Phyſicians themſelves, whoſe Intereſt " it was to be thoroughly verſed in theſe Things, " diſſected human Bodies, with a View to diſ- " cover them: But, ſay the Empirics, they are " not, by that means, better underſtood or com- " prehended by us; becauſe it is poſſible, that, " ſo ſoon as they are diſcovered and expoſed to " View, they may aſſume a Nature different to " what they had before."

The ſame RIOLAN having proved, in general, that the antient Phyſicians ſometimes diſſected Men, endeavours to ſhew, in a particular Manner, that HIPPOCRATES, ARISTOTLE, and GALEN, did ſo too. As for the two firſt, they come not under our Conſideration at preſent. I ſhall therefore only enquire a little into the Truth of his Pretences with regard to GALEN, in whoſe Favour he ſtands up againſt ſome Moderns, who have maintained the contrary. " People, ſays " he, have no Reaſon to accuſe GALEN of never " having diſſected human Subjects, and of hav- " ing taught the Anatomy of an Ape inſtead of " that of a Man. I could eaſily prove, by a " great many Quotations from this Author, that " he has diſſected both Apes and Men; but that " he has only taught the Anatomy of Man."

Upon this Occaſion he cites two or three Paſſages from GALEN, by which, indeed, it appears, that this Author treats, or at leaſt ſays he treats, of the Anatomy of Man: And in one

* Academic Quæſt. Lib. IV.

Paſſage

Paſſage he even promiſes to publiſh ſeparately the Anatomy of ſome other Animals.

The Words of this laſt mentioned Paſſage run thus: " I have not here a Deſign to enumerate " the Number of Lobes which make up the Li- " vers of other Animals, becauſe I have not, as " yet, deſcribed the particular Structure of any " of their Organs, except in ſome Paſſages, " where I have been obliged to do it in order to " illuſtrate what I ſay concerning Man: But, if I " live, I ſhall, ſome Time or other, deſcribe the " Structure of the Bodies of Beaſts, and furniſh " out an exact Anatomy of all their Parts, as I " have now done with regard to the Parts of " Man."

Riolan quotes another Paſſage, wherein Galen, when talking of ſome Anatomiſts of his Days, ſays, that " It was no Wonder if they " were deceived, ſince they only diſſected the " Hearts and Tongues of Oxen; never conſider- " ing, at the ſame Time, that theſe Parts are not " in thoſe Animals the ſame as they are in Men."

One may reaſonably ſuppoſe, that if Galen had not himſelf examined thoſe Parts in Man, he would not have been ſo forward in cenſuring thoſe who had not done it more than himſelf.

After the Paſſage in which Galen commends Herophilus for learning Anatomy by diſſecting Men, he adds, that " moſt other Phyſicians diſ- " ſected only Beaſts." This Paſſage proves, that Herophilus was not the only Anatomiſt who diſſected Men: If none, except he, had done ſo, our Author, inſtead of theſe Words, " moſt " other Phyſicians," ſhould have ſaid, " all other " Phyſicians."

Now if ſome of the Phyſicians of his Time diſſected human Bodies, it is very probable, conſidering the Fondneſs he diſcovers for Anatomy,

that he was not idle in this Reſpect, whilſt others were labouring to improve themſelves. I believe then, as well as RIOLAN, that GALEN may poſſibly have diſſected human Bodies; but it is probable he did ſo very rarely, and perhaps but imperfectly too.

What has already been ſaid upon this Head proves, that the Thing could not be undertaken without a great deal of Difficulty; and in this Sentiment GALEN himſelf confirms us, by the Pains he is at in ſpeaking of ſeveral other Methods in which he thought Anatomy might be learned. He adviſes * to make Choice of that Species of Apes which bear the neareſt Reſemblance to Man; or if ſuch, continues he, cannot be found, we muſt diſſect thoſe whoſe Heads reſemble that of a Dog, or Satyrs, or Lynxes. If theſe Animals ſhould ſtill be wanting, we muſt make Uſe of Bears, Lions, Weaſels, or Cats; becauſe theſe Animals have a kind of Fingers reſembling thoſe of Men.

He goes on thus: " I have never made an " Attempt to diſſect Ants, Gnats, Fleas, or any " ſuch minute Inſects; but I have often diſſected " Weaſels, Rats, Serpents, and ſeveral Species " of Birds and Fiſhes; by which I have diſco- " vered, that the ſame Principle of Intelligence " is employed in the Formation of all Animals, " every one of which has the Structure and Me- " chaniſm of its Body adapted to the State and " Condition of its Nature."

It alſo appears that GALEN ſometimes diſſected Hogs and Goats: And he himſelf † ſpeaks of an Elephant, the Whole, or at leaſt ſome Parts of which, he had diſſected at Rome.

* Anatom. Adminiſtrat. Lib. VI. Cap. 1.
† Ibid. Lib. VII. Cap. 10. De Uſu Part. Lib. XVII. Cap. 1.

It

It will, no doubt, be ſaid, that our Author adviſed to begin with diſſecting Beaſts, and to finiſh and perfect our Knowledge by diſſecting Men. All this is true; but let us ſee in what Strain he talks of this Affair. "I adviſe you, ſays he*, "firſt to exerciſe yourſelf thoroughly upon Apes; "that, if you ſhould find an Opportunity of diſ-"ſecting a human Body, you may be able rea-"dily to diſcover and know each Part of it; in "which Caſe, you will be foiled in your At-"tempts, unleſs, before-hand, you have fre-"quently exerciſed yourſelf upon other Subjects." For want of ſuch a previous Exerciſe, thoſe who diſſected the Bodies of the Germans, during the War undertaken by that People againſt Marcus Aurelius, reaped no other Advantage from their Labours than a Knowledge of the Situation of the Viſcera: But a Phyſician who has before tried his Hand upon other Animals, and eſpecially Apes, at once ſees the Peculiarities of the Parts he diſ-ſects. It is eaſier for a Man of Skill and Practice in Anatomy with a ſingle Glance of his Eye to diſcover what he has elſewhere ſeen before, than for a Novice in the Art to perceive even the moſt evident Things at his greateſt Leiſure.

Many of this firſt Claſs of Men have very quickly diſcovered what they wanted to ſee, upon the Bodies of thoſe who were condemned to Death, or expoſed to the Fury of wild Beaſts, or upon the Bodies of Robbers, who were denied the Privilege of Burial. Beſides, large Wounds, or deep and hollow Ulcers, have ſometimes diſcovered, to theſe Men of Skill, many Parts of the human Body reſembling thoſe they had formerly ſeen in Apes; whereas thoſe who had never en-

* Adminiſtrat. Anatom. Lib. III. Cap. 5.

deavoured

deavoured to improve themſelves upon thoſe Animals, could reap no Advantage upon Occaſions of this Nature.

Thoſe who have frequently diſſected the Bodies of expoſed Children well enough know, that the Bodies of Apes and Men very much reſemble each other. It is not to be doubted but GALEN employed ſome of thoſe Means, or others of a like Nature, in order to inſtruct himſelf in Anatomy; and the Anatomy acquired in this Shape was by him ſtyled Ἀνατομὴ κατὰ περίπτωσιν, or Anatomy acquired by Accident; which was the only Kind approved of by Empirics. That GALEN enjoyed Opportunities of this Nature is plain, from another Paſſage; where, after having adviſed young Phyſicians to travel to Alexandria, in order to ſee the Skeletons, and not to ſatisfy themſelves with what they read in Books upon that Head, he adds theſe Words:

" I have often examined the Bones of Men, " when Sepulchres or ruined Monuments have " fallen in my Way. A Sepulchre, ſlightly built " upon the Brink of a River, happened to be " deſtroyed by the Impetuoſity of the Torrent, " which had overflowed it; ſo that the Body, " which had been laid in this Sepulchre, being " carried off by the Current, ſtopped, at laſt, in " a Place not unlike a Harbour, ſurrounded with " pretty high Banks. I had an Opportunity of " ſeeing this Body, the Fleſh of which was already rotten, but the Bones were ſtill con- " nected with one another; ſo that one would " have ſaid, it was a Skeleton prepared for the " Inſtruction of young Phyſicians. One Day I " alſo ſaw the Carcaſs of a Robber lying on a " Mountain, far enough from any public Road: " This Robber was killed by a Traveller, whom " he had attacked; and the Inhabitants of the

" ad-

“ adjacent Parts refuſing to bury him, becauſe “ they judged a Man ſo wicked the proper Prey “ of Vultures; his Bones were, two Days after- “ wards, ſtripped of all their Fleſh, and dry, “ like thoſe prepared for the Inſtruction of Phy- “ ſicians.”

Galen ſpeaks alſo, in the ſame Chapter, of a Diſeaſe, attended with Carbuncles, that had raged in moſt of the Cities of Aſia, and afforded him Opportunities of examining the Situation and Diſpoſition of the Muſcles of ſeveral Parts that were ſtripped of the Skin, and ſome Part of the Fleſh.

If our Author confined himſelf to the Methods above ſpecified, he ſurely cannot be ſaid to have made complete and regular Diſſections of the human Body. Among all the Subjects, from which he ſays Anatomy may be learned, none, except the expoſed Children, ſeem calculated for furniſhing him with the Materials of a complete Anatomy; becauſe it was no difficult Matter to carry off ſome of theſe little Bodies, and afterwards diſſect them, with the Leiſure neceſſary for that Purpoſe. And this, in my Opinion, he himſelf ſeems to inſinuate, when he ſays, that “ thoſe “ who frequently diſſect expoſed Children, well “ enough know that the Body of Man very much “ reſembles that of an Ape.”

If Diſſections of this Nature were often made in the Days of Galen, as we may gather from this Paſſage, it is probable that he, like others, employed himſelf in this Way, tho’ a Principle of Caution might reſtrain him from making a public Declaration of it, on Account of the Averſion that then reigned in the Minds of People againſt Practices of that Nature.

It may be ſaid, that it was not much more difficult to get ſome of the Bodies of executed Criminals carried off; but he no-where inſinuates, that

that any one made the leaſt Attempt of this Kind. For when he ſpeaks of what was learned by examining the Bodies of Robbers, or other Carcaſſes caſually found in the Fields; he informs us, that this Examination was made upon the very Spot where ſuch Bodies were found, by endeavouring, as ſoon as poſſible, to diſcover the Part or Circumſtance ſought for. This may be gathered from the Paſſage already quoted; where he ſays, that "thoſe who have diſſected Apes, are able ſpeedily to inform themſelves, by means of the Carcaſſes they find in the Fields, with regard to the Diſpoſition of thoſe Parts, which they may have formerly ſeen by diſſecting Animals." In the Courſe of this Paſſage he three or four Times repeats the Word ſpeedily, which expreſſes the Shortneſs of the Time that he himſelf, or any Body elſe, had to view the Parts of the Subjects we are now ſpeaking of; for Fear, no doubt, of being ſurpriſed in an Action that muſt have ſtruck Terror to the Spectators, and muſt be owned to be, in its own Nature, none of the moſt agreeable.

In ſhort, the Pains Galen is at to ſpecify all the other Means of learning Anatomy, which we have mentioned, ſufficiently prove, as we have already obſerved, that, in theſe Days, regular Diſſections of the human Body could be made but very rarely, and with a great deal of Difficulty. A collateral Proof of this is, that ſuch Diſſections were not publickly made in the Schools of Phyſicians; for we may well ſuppoſe, that, if they were made in any Part of the World, it muſt have been at Alexandria, the Capital of Egypt, where the Cuſtom of opening the Dead, in order to embalm them, might have been ſuppoſed, in ſome meaſure, to reconcile and inure them to the Horror that attends a complete Diſſection: But

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we do not find that any Thing of this Nature was practiſed there ſince the Days of HEROPHILUS and ERASISTRATUS, or of the antient Kings of that Country. All that was done, in this Reſpect, even in that famous Medicinal School which flouriſhed in the Days of GALEN, was, to teach OSTEOLOGY upon human Skeletons, which might have been very antient.

If the Maſters of this School had exhibited, upon human Subjects, all the other Parts of the Anatomy of Man; GALEN, and a great many other Authors, had not failed to acquaint us with it, in numberleſs Paſſages.

As for thoſe Paſſages, from many Authors, which have, ſince the Time of RIOLAN, been advanced to prove, that, in the Days of Antiquity, human Diſſections were practiſed; it is eaſy to ſhew, that almoſt all of them have a Reference to what paſſed long before the Times in which theſe Authors wrote; and that the Accounts handed down, of HEROPHILUS and ERASISTRATUS, might have laid a Foundation for all that has been ſaid on that Subject.

But to return to GALEN: Taking it for granted, that he diſſected ſome human Bodies; yet nothing is a more convincing Proof of his not having diſſected a ſufficient Number, than his deſcribing, in ſeveral Paſſages, the Parts of Apes, or ſome other Animals, inſtead of thoſe of a Man. This has been clearly ſhewn by VESALIUS; and thoſe who have maintained the contrary, have been miſerably blinded and miſled by their ſuperſtitious Attachment to GALEN.

But tho' GALEN has ſometimes confounded the Parts of Beaſts with thoſe of Men, his Anatomy is, nevertheleſs, a very valuable Work; and VESALIUS himſelf had a high Veneration for it: And, indeed, it muſt be owned, that nothing

could ſet the Merit of its Author in a fairer or truer Light than this Piece; if it be true, as he ſays, that no one had wrote well on Anatomy before him; and that he had made many important Diſcoveries in this Branch of Phyſic.

It is indeed poſſible, that, conſidering his Attachment to Anatomy, he might have made ſome Diſcoveries of his own in that Science; though, at the ſame Time, his Propenſity to commend himſelf, muſt render every Thing he ſays, concerning himſelf, ſuſpected. But the Truth is, whether he was the firſt who placed Anatomy on a good Foundation, or whether he raiſes his own Character on the Labours of others; from which, at the ſame Time, he has not drawn all the Advantage that could have been wiſhed; yet ſtill it is very certain, that we ſhould have ſuffered very conſiderably, if all his anatomical Works had been loſt; ſince they are the only remaining Monuments of all that the Antients wrote upon this Subject: For what elſe we find, of that Nature, is ſcarce worth Notice, if we except what ARISTOTLE has given us upon that Head.

It is true, GALEN had not attained to Perfection; neither can the Moderns pretend to it: And it is probable, that, without thoſe Lights with which he ſupplied the very Men who have cenſured him, we ſhould have ſtill been in the Dark, with regard to a great Part of that which he has clearly demonſtrated. His two principal Treatiſes of Anatomy are, Anatomical Adminiſtrations, and The Uſe of the Parts of the Human Body. The former contained fifteen Books, of which the ſix laſt are loſt; the latter, which we have complete, contains ſeventeen. We have alſo a Book of his that treats of the Bones in particular; another, on the Diſſections of the Muſcles; a third, on the Diſſection of the Nerves, which

which is imperfect; a fourth, on the Diſſection of the Veins and Arteries; a fifth, in which the Author proves, in Oppoſition to ERASISTRATUS, that there is Blood in the Arteries; a ſixth, on the Anatomy of the Matrix; a ſeventh, on the Organ of Smelling; an eighth and ninth, on the Uſefulneſs and Cauſes of Reſpiration; a tenth and eleventh, on the Motion of the Muſcles; a twelfth, on the Formation of the Fœtus; and two others, concerning the Semen; without taking into the Account what we find concerning Anatomy in his Books on the Natural Faculties, and elſewhere, diſperſed in his other Works. GALEN wrote ſeveral other Books, that are loſt; in ſome of which he treated of the Anatomy of HIPPOCRATES; and, in others, of that of ERASISTRATUS: In a third Work he treated of the Diſſection of dead Bodies; and, in a fourth, concerning that of living Animals.

It were to be wiſhed, that all theſe had reached our Hands, eſpecially thoſe Pieces relating to the Anatomy of HIPPOCRATES and ERASISTRATUS; as alſo the Abridgments he made of the anatomical Works of LYCUS and MARINUS; the latter of whom wrote twenty Books, which were abridged by GALEN, and of which he has preſerved the Titles, which are ſo curious, as to lay a juſt Foundation for our lamenting the Loſs of ſo great a Work.

But tho' we have not all the Works of GALEN, yet thoſe we have, happen luckily to comprehend almoſt the Whole of his Anatomy: And if his Anatomical Adminiſtrations are not complete, the other Books we have mentioned, and eſpecially thoſe concerning the Uſe of the Parts, ſupply that Defect: For this Book, on the Uſe of the Parts is a Maſter-piece, has been juſtly admired in all Ages, and ſufficiently diſcovers the Extent

of

of its Author's Genius; ſince in it the Phyſician, as well as the Philoſopher, may find Satisfaction. But what, in a particular Manner, ſtrikes Chriſtians with Admiration, is, that GALEN, tho' a Heathen, acknowledged One God, All-wiſe, All-good, and All-powerful; the Creator of Man, and all other Animals.

The Words he uſes in one Paſſage of this Book*, have not only ſtrong Senſe, but alſo ſomewhat of a divine and ſtriking Energy in them. "In "writing theſe Books, ſays he, I compoſe a true "and real Hymn to that awful Being who formed "us all; and, in my Opinion, true Religion does "not ſo much conſiſt in ſacrificing many Heca- "tombs on his Altars, or in making him rich "and coſtly Preſents of the moſt fragrant and "exquiſite Perfumes, as in being perſuaded our- "ſelves, and endeavouring to perſuade others, "that he is poſſeſſed of unerring Wiſdom, irre- "ſiſtible Power, and all diffuſive Goodneſs. For "his having ranged all Things in that Order and "Diſpoſition which is beſt calculated for the "Continuation of their reſpective Beings, and "his having condeſcended to diſtribute his Fa- "vours to all his Works, is a glaring Proof of "his Goodneſs, which calls aloud for our Hymns. "His having found the Means neceſſary for the "Eſtabliſhment and Preſervation of this beautiful "Order and Diſpoſition, is an inconteſtable Proof "of his Wiſdom; as his having done every Thing "he pleaſed, is of his Omnipotence."

It is not in one Paſſage, only, that GALEN talks in this exalted Strain; theſe are ſo much the genuine Sentiments of his Heart, that he loſes no Opportunity of inculcating them; and confuting,

* De Uſu Part. Lib. III. cap. 10.

at

at the ſame Time, the Epicureans; who maintained, that this beautiful and harmonious Frame of Nature was the blind Reſult of a fortuitous Concourſe of Atoms. It is true, that he * oppoſes Moses for having maintained, that the Will or ſole Command of God was the only Cauſe of all Things: Galen does not admit of this Principle of Moses, unleſs the Will of God be taken in Conjunction with the Choice that he made of the moſt proper Materials for anſwering the particular Ends he had propoſed to himſelf, after having known what was really beſt, with regard to the Arrangement of each Body: "For, ſays our "Author, God could not have formed Man out "of a Stone, nor an Ox or a Horſe out of a "Parcel of Aſhes."

Galen did not reflect, that, as God was the Maſter and Creator of Matter; ſo his Will was ſufficient to make any Part of it aſſume that particular Form, and all thoſe other Modifications, that were requiſite for anſwering his Ends.

If Epicurus, bewitched as he was with his Atoms, had acknowledged the ſupreme Cauſe of their Arrangement, he would have reaſoned better upon this Subject than Galen; but Galen was miſled by Plato, or Aristotle, and not by Epicurus.

Theophilus Protaspatarius, or rather Protaspatharius, a Greek anatomical Author, lived, according to Fabricius, in the Time of the Emperor Heraclius. He was, undoubtedly, a Chriſtian, and probably a Monk, as he is ſtyled in ſome antient Manuſcripts.

He wrote five Books, *Περὶ κατασχευῆι ἀνθρωπίνου σωμαμος*, of the Fabric of the human Body; in

* De Uſu Part. Lib. xi. Cap. 14.

which he is ſaid to have epitomized excellently, GALEN Of the Uſe of the Parts; and, beſides, mentions ſome Things not to be found in any preceding Author. Thus he aſſerts, that the firſt Pair of Nerves, ariſing from the firſt Ventricles of the Brain, is extended to both the Noſtrils; and that, by means of theſe, Smells are conveyed to the Brain.

Thus, alſo, he ſays, that two Muſcles are concerned in ſhutting the Eye-lids; but that they are opened by one only. According to him, the Subſtance of the Tongue is muſcular.

He alſo firſt deſcribed a very ſtrong Ligament, that is common to, and fixes, all the Articulations of the Vertebræ. This Paſſage is very remarkable: And, as it may ſerve as a Specimen of his Work, I ſhall inſert it *.

" But as it is neceſſary for a Man to bend him-
" ſelf forwards and backwards, it did not ſeem
" ſufficient to the good Providence of God to
" furniſh each particular Articulation of the Ver-
" tebræ with proper Ligaments; which, how-
" ever, are very neceſſary, and of great Uſe:
" But, beſides theſe, is added, on the Outſide of
" the Spine of the Back, a Ligament of a yellow
" Colour, and of a nervo-cartilaginous Sub-
" ſtance, as a common Ligament to all the Arti-
" culations of the Vertebræ of the Spine."

It is probable, that this Author alſo knew, that the Subſtance of the Teſticles is vaſcular: For he

* Ἐπειδὴ δὲ καὶ κύπτειν ἔμελλεν ὁ ἄνθρωπος, καὶ ἀνανεύειν, οὐχ ἠρκέσθη ἡ ἀγαθὴ τοῦ Θεοῦ πρόνοια εἰς μόνους τοὺς κατὰ μέρος συνδοῦντας δέσμους τοὺς σπονδύλους· ἀναγκαία γὰρ ἐστὶ καὶ ἰσχυρὰ ἡ χρεία· ἀλλ᾽ ἔξωθεν μὲν τῆς ἀκάνθης τῆς ῥαχίως, ἐπέθηκε σύνδεσμον ξανθὸν μὲν τῇ χροιᾷ νευροχονδρώδη δε τῇ ἰδέᾳ ἀπὸ κέφαλῆς ἄκρας συνδοῦντα ἁπάδας διαρθρώσεις τῶν σπόνδυλων κοινὸν σύνδεσμον.

takes

takes Notice of a prodigious Number of capillary Veſſels, as fine as a Spider's Web, which, he ſays, are diſperſed in the glandular Subſtance of theſe Parts.

This Work of THEOPHILUS was publiſhed at Paris, in Greek, in 1555, Octavo. Dr. DOUGLAS informs us, that it was alſo publiſhed in Greek at Paris in 1540; but I am afraid this is a Miſtake: For Vander LINDEN and FABRICIUS inform us, that the Paris Edition of 1540 is only the Latin Tranſlation of JUNIUS PAULUS CRASSUS: But, as I have never ſeen this Edition, I cannot determine it. FABRICIUS has given this whole Treatiſe, in Greek and Latin, at the End of the twelfth Volume of his Bibliotheca Græca. The above mentioned Tranſlation was alſo publiſhed at Venice in 1536, Octavo; at Baſil in 1539, Quarto; and, with ſome other Authors, at Baſil in 1581.

ORIBASIUS, who, in two large Books, has deſcribed all the Parts, then known, of the human Body; and aſſigned the proper Office to each of them: But he has added little to what GALEN has diſcourſed of in his anatomical Works; and, on Account of this Treatiſe, rather than any other of his Writings, he deſerves the Name given him of Simia GALENI, the Ape of GALEN. Only one Thing we find, that is either omitted by GALEN, or loſt, together with ſome other of GALEN's Works, the firſt Deſcription of the ſalivary Glands, which is this: "On each Side of the "Tongue lie the Orifices of the Veſſels that diſ"charge the Spittle, and into which you may put "a Probe: Theſe Veſſels take their Riſe from "the Root of the Tongue, where the Glands "are ſituated. They riſe from theſe Glands in "much ſuch a Manner as Arteries uſually do, "and convey the ſalivary Liquor that moiſtens

" the Tongue, and all the adjacent Parts of the " Mouth." See ORIBASIUS.

NEMESIUS is a Writer whoſe Name muſt by no means be omitted in a Hiſtory of Anatomy. He was Biſhop of Emiſſa, a City of Phœnicia, at the latter End of the fourth Century; and wrote a Treatiſe, Περὶ φύσιως ἀνθρώπȣ, Of the Nature of Man, of which there have been the following Editions: Antwerpiæ, 1565, Octavo, in Greek, with the Latin Tranſlation of NICASIUS ELLEBODIUS. Oxon. 1671, Octavo, Greek and Latin. Vander LINDEN and DOUGLAS mention an Edition at Antwerp 1584, Octavo, but FABRICIUS takes no Notice of it. A Latin Tranſlation, by GEORGIUS VALLA, was printed at Antwerp 1538; and an Engliſh Tranſlation was printed at London 1636, Octavo.

As to the anatomical Diſcoveries of NEMESIUS, Dr. FREIND makes the following Reflections: " The Oxford Editor aſcribes two Diſcoveries to " him, one of which was the moſt conſiderable " that ever was made in Phyſic. The firſt is con- " cerning the Bile, which is conſtituted, as NE- " MESIUS ſays, not only for itſelf, but for other " Purpoſes: For it helps Digeſtion, and contri- " butes to the Expulſion of the Excrements; " and therefore it is, in a Manner, one of the " nouriſhing Powers: Beſides, as a vital Faculty, " it imparts a Sort of Heat to the Body. And, " for theſe Reaſons, it ſeems to be made for itſelf. " But, becauſe it purges the Blood, it ſeems to be " formed for the Sake of the Blood." " Here, " ſays the Editor, the Syſtem of the Bile is plainly " and accurately delivered; that very Syſtem " which SYLVIUS DE LE BOE, with ſo much Va- " nity, boaſted he had invented himſelf."

And,

And, indeed, ſo far is true, that here is the true Foundation of SYLVIUS's Reaſoning: And, if this Theory be of any Uſe in Phyſic, NEMESIUS has, I think, a very good Title to the Diſcovery. But there follows a much more material Point; and the Editor contends, that the Circulation of the Blood, an Invention that the laſt Century ſo much bragged of, was known to NEMESIUS, and deſcribed in very plain and ſignificant Terms; which are theſe: "The Motion of "the Pulſe takes its Riſe from the Heart, and "principally from the left Ventricle of it: The "Artery is, with great Vehemence, dilated and "contracted, by a Sort of conſtant Harmony and "Order. While it is dilated, it draws the thinner Part of the Blood from the next Veins; "the Exhalations or Vapours of which Blood is "made the Aliment for the vital Spirit; but, "while it is contracted, it exhales whatever Fumes "it has thro' the whole Body, and by ſecret Paſſages; ſo that the Heart throws out whatever "is fuliginous thro' the Mouth and Noſe, by Expiration."

Upon this ſingle ſlender Proof does he attribute this great Diſcovery of the Circulation to NEMESIUS; and thoſe who have inſiſted that it was known both to HIPPOCRATES and GALEN, have full as good Arguments on their Side. I will only ſay this, that from this very Deſcription, and from what the ſame Author ſays of the Liver in the ſame Chapter, that it miniſters Nouriſhment to the Body by the Veins, one may demonſtrably infer, that NEMESIUS had no Idea of the Manner in which the Circulation of the Blood is performed.

It muſt be remarked, that, from the Time of GALEN to the Beginning of the fifteenth Century, Anatomy made but very ſlow Advances; for moſt

corrected by CARPUS. It alſo appeared with KETHAM'*s Faſciculus Medicinæ*, Anno 1500, Folio.

ALEXANDER BENEDICTUS flouriſhed about 1495. He was a Native of Verona, cultivated Anatomy, and wrote a Book intituled *Alexandri, Benedict. Phyſici, Anatomiæ, ſive de Hiſtoria Corporis Humani*, Libri V. printed Baſil, 1527, Octavo; Argent. 1528, Oct. Pariſ. 1514. His *Epiſt. Nuncupat.* was printed Venet. 1497. and his *Opera Medica* Venet. 1535, Folio; Baſil, 1539, Quarto and Folio; Ibid. 1549, Folio. His *Hiſtoria Corporis Humani*, together with ſome of his Aphoriſms, was printed in 1527, Duodecimo; but at what Place, is not mentioned.

He maintained, that the yellow Bile flowed from the Gall Bladder to one particular Part of the Stomach; and obſerved two Foramina near the urinary Paſſage in Women, which he falſly aſſerts to be the Orifices of Veins, and from which, he ſaid, a certain Humour flowed, that was not prolific.

ALEXANDER ACHILINUS was a Native of Bologna. His Annotations on the Anatomy of MUNDINUS were publiſhed, together with the *Faſciculus Medicinæ* JOHANNIS DE KETHAM, at Venice 1522, Folio; and his Treatiſe *De Humani Corporis Anatomia* was publiſhed at Venice 1521, Quarto.

He is ſaid to have diſcovered the Malleus and Incus of the internal Ear.

GABRIEL DE ZERIS, of Verona, flouriſhed at the latter End of the fifteenth and Beginning of the ſixteenth Century. His anatomical Pieces were publiſhed Venet. 1502. and 1533, Folio; and Marpurg. 1537. and 1545, Quarto; together with the Anatomy of MUNDINUS.

GUIDO DE CAULIACO was a Native of France, and ſtudied at Montpelier under RAYMUND. He flou-

flouriſhed in the Year 1363, at which Time he wrote a large Body of Surgery. His Works, under the Title of *Chirurgiæ Tractatus ſeptem cum Antidotario*, were printed Venet. 1490, 1519, 1546, Folio; Lugd. 1572, Octavo; 1585, Quarto; Venet. 1499, Folio; Lugd. 1559.

He firſt taught, that Inciſions about the Eyebrows ſhould be made in the ſame longitudinal Direction with the Body itſelf, and not in that of the Rugæ of the Forehead; becauſe the Muſcles, that ſerve to move the Supercilia, run in the former, and not in the latter, Direction.

With regard to the Os Adjutorium, or Humerus, he advanced ſomewhat that had the Appearance of being new; but they may be more juſtly aſcribed to GALEN, the great Reſtorer of Anatomy, as will plainly appear from his Works*.

JACOBUS BERENGARIUS CARPENSIS was the great Reviver of Anatomy. He is diſtinguiſhed with the Epithet CARPENSIS from the City Carpi in Italy; is likewiſe called CARPUS alone, JACOBUS CARPUS, and, by FALLOPIUS, JACOBUS CARPENSIS: But theſe three laſt mentioned Names he aſſumes to himſelf in his *Iſagoge*.

He flouriſhed in the Year 1522, and was Profeſſor of Anatomy and Surgery in the Univerſity of Pavia. His Commentaries upon the Anatomy of MUNDINUS were printed at Bononiæ 1521, Quarto; his Anatomy was printed at Bononiæ 1523, Quarto; Coloniæ 1529, Octavo; Argent.

* I have not traced his Anatomy from its Origin to the fifteenth Century: But the Induſtry of the Revivers of this Science in the ſixteenth, which had, from the Time of GALEN, lain, in a great Degree, uncultivated, will furniſh us with more frequent and ample Diſcoveries; though it muſt be confeſſed, that many have been pretended to be made, which were known even in the Infancy of Anatomy.

1533, Octavo; Venet. 1535, Quarto. His Practical Anatomy was tranſlated into Engliſh by H. Jackson, and printed at London 1664.

He was the firſt that uſed Unction with Quickſilver, for the Cure of the *Lues Venerea*, and became immenſly rich by his Practice that Way.

He firſt diſcovered the Ecphyſis, or Appendix of the Inteſtinum Cæcum, which he calls the Additamentum Coli; and, under that Name, deſcribes it at Length. He denies that the ſeven Cells of Mundinus are to be found in the Uterus, and admits only of one Cell or Cavity.

He was acquainted with the ſublingual Glands, and their Ducts; and thinks, that the three Diviſions in the Muſculi Recti of the Abdomen are the Tendons of three Muſcles, ſerving for the Contraction of the Abdomen.

He firſt diſcovered Caruncles in the Kidneys, reſembling the Nipples of a Breaſt. That Line which now goes by the Name of Linea Alba, was by him called Linea Centralis, becauſe it reached along the Middle of the Belly; and thought that the Proceſſus Mammillares were not, on account of their exceſſive Softneſs, to be reckoned among the Nerves.

Concerning the Ear, he has theſe Words: "Two little Bones are adjacent to this Membrane (he means the Tympanum), which, being moved by the undulating Air, mutually ſtrike each other, and, by their Motion, excite what we call Sound, in the Ear. This is the real Structure of the Parts, which, tho' very remarkable, has yet been obſerved by few."

He is therefore unjuſtly thought, by ſome, to be the Diſcoverer of theſe little Bones; ſince he aſſigns the ſame Uſe to them, that others have done before him: And, which is ſtill more, he no-where pretends to be the Diſcoverer of them.

Nicolaus Massa was a Venetian by Birth, and flouriſhed about the Year 1530. His *Liber Introductorius Anatomiæ* was printed Venet. 1536, Quarto; 1559, Quarto. His *Epiſtolæ Medicinales* were printed Venet. 1542, Quarto; 1550, Quarto; 1558, Quarto.

Riolan, and ſome others, ſeduced by his Authority, aſcribe the Invention of the Muſculi Pyramidales to him; but they have nothing to ſupport their Opinions: For that Muſcle which is taken for the pyramidal Muſcle of Massa, is more properly called the cremaſter Muſcle, which it really is.

The Septum Scroti, which ſome Moderns boaſt of as their own Diſcovery, is elegantly deſcribed by him in theſe Words: "This Bag (he means "the Scrotum) has, beſides, an intermediate "Membrane, that divides the right Teſticle from "the left; ſo that the Scrotum has two Sinuſes. "Hence it happens, that it is ſometimes diſtended "on one Side by a Defluxion of Humours, or a "falling down of the Inteſtines, whilſt the other "Side remains in its natural State."

He denied the Exiſtence of the Panniculus Hymenæus, which, according to Mundinus, blocked up the Mouth of the Matrix; and, in its Stead, maintained, that ſome Rugæ, mutually connected with Veins and Ligaments, were relaxed and broken, when a Woman was deflowered.

He deſcribed the Ducts of the renal Caruncles, thro' which the Urine is ſtrained, and which are now called the Tubuli Urinarii. Carpus.

Concerning the Anatomy of the ſeminal Veſſels, he expreſly affirms, that the ſpermatic Vein and Artery do not at all meet, but paſs ſeparately to the Teſticles; and demonſtrates, that the Subſtance of the Tongue is muſcular; and that it is covered with a double Skin.

He

He alſo aſſerted, that the Neck of the Uterus was muſcular, and endowed with a voluntary Faculty; takes the Membrana Frontis Carnoſa for a real Muſcle; and aſſerts, that the Oſſicula Auditus, which ſtrike the Tympanum of the Ear, were known to Anatomiſts in the Time of ACHILLINUS.

JOHANNES GUINTERIUS is ſtyled ANDERNACUS, becauſe he was born in Andernacum, a Town of Ubich on the Rhine, in the Year 2487. His Works, under the Title of *Anatomicarum Inſtitutionum ex Galeni Sententia, per Johannes Guinterium Andernacum Medicum, Libri quinque*, were printed Baſil. 1536, Octavo; 1539, Quarto; Petav. 1538, Octavo; Wirtemberg, 1613, Octavo: And his Piece, *De Medicina Veteri & Nova*, was printed Baſil. 1571, Folio, 2 Vols.

He firſt called that glandular Body which is ſituated in the Middle of the Meſentery, and conſiſts of a ſoft and yielding Subſtance, the PANCREAS; and boaſts of his being the Diſcoverer of the Complication of the ſpermatic Vein and Artery a little before their Inſertion into the Teſticles; which, he ſays, was never obſerved before him; and which, he adds, he ſhewed to VESALIUS, when he was ſtudying Anatomy at Paris.

The Uterus, he ſaid, had two Sinuſes, correſponding to the Number of the Breaſts, not divided by an intermediate Membrane, but terminating in one narrow Cavity, which he called the Neck of the Womb; which Neck, he ſaid, terminated at the Sinus Muliebris, which he alſo called the Pudendum.

He alſo admitted of the Membrana Allantos; and aſſerts, that the Muſcle which ſurrounds the Neck of the Bladder conſiſts of tranſverſe Fibres, and has various Offices. For, firſt, it ſhuts the Bladder; and then, after the Diſcharge of the Urine,

Urine, contracting itſelf every way, propels what remains in the Meatus Urinarius.

Ludovicus Bonnaciolus was a Native of Ferrara, and flouriſhed about the Year 1530. His *Enneas Muliebris* was publiſhed Argentin. 1537, Octavo.

He firſt deſcribed the Nymphæ and Clitoris as ſeparate and diſtinct Parts, which had not been diſtinguiſhed by the Antients; and ſaid, that the Mouth of the Uterus reſembled, in Figure, the Glans of the Penis.

The Teſticles, according to him, were not perfectly ſpherical, but reſembled a Sphere gently compreſſed on each Side.

Andreas Vesalius was born at Bruſſels, a Town of Brabant, in the Year 1514. His ſuperior Genius, in Conjunction with his indefatigable Application and Induſtry, ſoon raiſed him to ſuch a Pitch of anatomical Knowledge, as rendered him, at once, the Ornament of his own, and the Admiration of future, Ages.

As it is the Fate of all Sciences to have their Votaries blindly and ſuperſtitiouſly attached to the Opinions of ſome particular Author of Note, till ſome daring Genius ventures to think for himſelf, and endeavours to make Authority fall a Sacrifice to Truth; ſo the Anatomiſts, at the Time Vesalius appeared, were ſo much blindfolded with the Authority of Galen, that, to have contradicted him, had been looked upon as Hereſy.

Vesalius, regardleſs of this unhappy State of Things, ventured to expoſe the Miſtakes, and correct the Errors, committed by Galen, both in Phyſic and Anatomy, eſpecially the latter: But as there is a Principle of Emulation interwoven with the very Frame and Make of human Nature; ſo it muſt follow, that uncommon Merit muſt create, if not Enemies, yet, at leaſt, Cenſurers, of Note

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and Diſtinction: This was the Fate of VESALIUS. Some diſtinguiſhed Authors have charged him with Ignorance, Want of Honour, Vain Glory, and Plagiariſm.

PICCOLHOMINUS, an Author of conſiderable Note, talks of him in this Strain: "When a "proper Opportunity occurs, I ſhall ſufficiently "ſhew, that whatever is good in that large Vo-"lume, wrote by VESALIUS, *De Re Anatomica*, "is borrowed from HIPPOCRATES, ARISTOTLE, "GALEN, and ſome others of the Antients, with-"out the Author's ſo much as mentioning their "Names; and that, whatever Things are falſe "and erroneous, which, indeed, are very many; "are the Product of his own Ignorance, and Im-"petuoſity of Temper. And tho' he has ſecretly "ſtole many Things from GALEN, yet he never "mentions his Name, unleſs it be with a View to "find Fault with him."

The Cenſure of CAIUS upon VESALIUS, is ſtill more remarkable. "We both lodged, ſays he, "in the ſame Quarters at Padua, at the Time "when VESALIUS wrote and prepared his Book, "*De Corporis Humani Fabrica*. One ALDINUS "JUNTA, a Venetian Printer, employed him to "correct the anatomical Works of GALEN, both "Greek and Latin; and, for that Purpoſe, ſe-"veral Emendations were ſent him: But he ren-"dered GALEN's Text more corrupt than it was "before, with no other View than that he might "have ſomewhat to find Fault with."

And tho' FALLOPIUS owns him to be the Father of Anatomy, yet he carps at his Opinion almoſt every-where. COLUMBUS talks thus of him: "I cannot but be ſurpriſed that he, who, "on all Occaſions, laſhes and chaſtiſes GALEN "for his having deſcribed Apes and Brutes, in-"ſtead of Men; ſhould yet, himſelf, be ſo ridi-"culous,

"culous, as to deſcribe the Larynx, Tongue, and "Eyes, of Oxen, and not of Men; without ſo "much as ever giving a Caution with regard to "it. He alſo aſcribed Muſcles to the Epiglottis, "which are only found in Brutes." EUSTACHIUS has alſo obſerved of him, that "He deſcribed "and delineated a Dog's Kidney, inſtead of a "Man's."

ARANTIUS ſtyles him the common Maſter of Anatomiſts, but accuſes him of having delineated the Pudendæ of Brutes, on Account of the Scarcity of the Bodies of Women; whereby it happened that VALVERDA, and thoſe who immediately followed him, taking Things upon Truſt, ſplit upon the ſame Rock.

JOHANNES BAPTISTA CARCAN. LEON. ſpeaks of him thus: "It is ſurpriſing that VESALIUS, "whilſt he accuſes GALEN, the chief of Phyſi"cians and Anatomiſts, of ſo many Blunders "and Errors; ſhould yet, himſelf, be ſo juſtly "liable to Cenſure in the ſame Reſpect: And, "what is ſtill worſe, by theſe his Accuſations, he "ſeems widely to have miſtaken GALEN's Mean"ing; aſcribing to him Things he never ſo much "as dreamed of; and affirming, that he denied "thoſe very Things that he inſiſted on in the moſt "diſtinct and explicit Manner: And whilſt he ſo "often wonders at, and finds Fault with, GA"LEN; he himſelf deſerves to be wondered at, "and found Fault with."

"The Style of VESALIUS, ſays RIOLAN, is "ridiculouſly pompous, and his Periods by far "too long; ſo that he generally throws a greater "Degree of Darkneſs upon Things that are, of "their own Nature, too obſcure. Beſides, I ſuſ"pect, that the Latin of that Book is none of "VESALIUS's, but the Language of ſome other "learned Man; ſince his *Chirurgia Magna*, his

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" *Examen Obſervationum Fallopii*, and his little " Book, *De Radice Chinæ*, are wrote in a quite " different Style." And, for this Reaſon, FALLOPIUS thinks that his great Work is only fit for thoſe who are well advanced in anatomical Studies.

But theſe ſharp and ill-natured Cenſures have not had more Influence upon the Fate of VESALIUS's Works, than a gentle Breeze of Wind would have upon Mount Caucaſus, or Athos: For his Works ever have been, and, for ought I know, ever will be, eſteemed, ſo long as Anatomy and Phyſic are thought neceſſary to the Good and Welfare of Mankind; and that is ſo long as human Nature endures*.

As for the Diſcoveries with which VESALIUS, by his indefatigable Labour and Induſtry, enriched Anatomy; if I was to enumerate them all, I ſhould not only find the Taſk difficult in itſelf, but inconſiſtent with my preſent Deſign: However, not to paſs them over entirely, he maintained, that " The Penis was connected, at the " Union of the Oſſa Pubis, by a certain ſmall " Ligament." This Ligament was delineated by CASTERIUS; and COWPER deſcribed and delineated it, under the Name of LIGAMENTUM PENIS

* His Work, *De Humani Corporis Fabrica*, was printed Baſil. 1543, Folio; ibid. 1555, ibid. 1563; Venet. 1568, Folio Min. ibid. 1604, Folio. His *Anatomia* was printed Francof. 1604, 1632, Quarto; Lugd. 1552, Duodecimo. His *Epitom. de Humani Corporis Fabrica Librorum* was printed Baſil. 1543, Folio; Colon. Agripp. 1600; Pariſ. 1560, Octavo; Wirtemberg. 1582, Octavo; Londini 1642, Folio. *De Modo propinandi Radicis Chinæ Decoctum*, was printed Baſil. 1546, Folio; Lugd. 1547, Decimoſexto. His *Examen Anatomicarum Obſervationum Gabrielis Fallopii*, was printed Venet. 1564, Quarto: The laſt Edition was *Veſalii Opera Omnia*, Lugdun. Batav. 1725, Folio. See Vander LINDEN's *De Scriptis Medicis*, and DOUGLAS's *Bibliothecæ Anatomicæ Specimen*.

Suspensorium. We are alſo indebted to Vesalius for the firſt Delineation of the Auditus Ossa, or Bones appropriated to Hearing.

He firſt diſcovered, that the Optic Nerve was not inſerted directly in the Center of the Eye, but a little to one Side. He likewiſe maintained, that the Ligamentum Teres Femoris was not inſerted into the Middle of the Head of the Femur, but rather into the Side of it.

I do not pretend to give the Life of Vesalius; for that would require a Volume by itſelf: My Deſign is only to ſhew the State of Anatomy, when he appeared; which, I hope, may be ſufficiently known from the preceding Hints.

Carolus Stephanus was a Phyſician, and Member of the Faculty at Paris; who, by the Aſſiſtance of Riverius, made ſuch Advances in Anatomy, as to acquire Credit enough to introduce Galen's Doctrine, which was unknown to the Age in which he lived. He alſo enriched Anatomy with ſome Diſcoveries; ſuch as the Membrana Apophysis within the Liver, at the Origin of the Vena Cava; leſt the Blood, elaborated there, ſhould regurgitate.

He firſt maintained, that the Oeſophagus and great Artery deſcended thro' different Apertures, tho' they lay very near to one another; which was quite the contrary to what Galen aſſerted: And ſays, that the Membrana Carnoſa is viſible in melted Fat. For if Fat be melted before the Fire, you will obſerve a thick Membrane remaining. He accurately deſcribed the Septum Scroti, firſt obſerved by Massa, and gives it the Names of Diaphragma and Septum.

His Works under this Title, *De Diſſectione Partium Corporis humani Libri tres, una cum Figuris, & Inciſionum declarationibus a Stephano Riverio Chi-*

rurgo Compoſitis, were printed Pariſ. 1545, Folio; and, in French, Paris 1546, Folio.

This, in general, is to be remarked, with regard to his Plates, that they are imperfect.

JACOBUS SYLVIUS was born at Amiens in Frenu, in the Year 1478; and was afterwards the Pupil of TAGAULITUS. He was a great Admirer of GALEN, and an inveterate Enemy to VESALIUS. Anatomy has been enriched with many of his Diſcoveries; particularly, he was the firſt who diſcovered thoſe Valves that he calls Epiphyſes, or membranous Epiphyſes, in the Mouths of the Vena Azygos, the jugular, brachial, and crural Veins; as alſo at the Trunk of the Vena Cava, which ariſes from the Liver.

FABRICIUS AB AQUAPENDENTE unreaſonably claims the Glory of this Diſcovery; but he only deſcribed them more accurately; and, from their Uſe and Structure, gave them the Name of Valves, which they retain to this Day.

He was alſo the firſt who obſerved the Muſculus Femoris Quadratus, and ranked it among the Muſculi Quadrigemini, as he calls them.

He accurately deſcribes the Origin of that Muſcle in the Thigh called Muſculus Rectus; and maintained, that the Tendons of the Muſculus Plantaris and Palmaris were wanting in ſome Subjects.

But what is moſt ſurpriſing, is, his receding from his Maſter GALEN, in aſſigning the Origin of the Muſculus Rectus Abdominis.

He mentions the large muſculous Subſtance in the Sole of the Foot, that runs out to the Sides of the Toes; and takes Notice of the Muſculi Pyramidales ariſing from the Os Pubis, and calls them Muſculi Succenturiati: And, indeed, he may deſervedly be ſaid to be the firſt Diſcoverer of them.

He alſo takes Notice of the Glands at the firſt Diviſion of the Aſpera Arteria; as alſo of two Glands at the Root of the Larynx; and of the glandular Subſtance of the Pylorus*.

MICHAEL SERVETUS was a Phyſician, and Native of Spain; a Man of an uncommon Genius. Happy had it been for him, if he had confined his Reſearches within the Bounds of Phyſic and Philoſophy! But, unluckily, he went beyond his Sphere, and plunged himſelf into the deepeſt and moſt abſtruſe Points of Theology: For he publiſhed a Piece againſt the myſterious Doctrine of the Trinity, and that, too, at a very unlucky Juncture; I mean the Dawn of the Reformation.

Upon this, CALVIN, the great Champion of that Cauſe, uſed his Intereſt to do him all the Injury he could. And as true Chriſtian Zeal had, in thoſe Days, degenerated into a moſt helliſh and execrable Spirit of Perſecution, he found it no hard Taſk to get him condemned to the Flames; and the Sentence was, accordingly, put in Execution at Geneva, in the Year 1553.

His ſeven Books, *De Trinitatis Erroribus*, were printed at Baſil, 1531; and his *Chriſtianiſmi Reſtitutio* was printed at Baſil, 1533. Tho' theſe Pieces made their Author fall an unfortunate Victim to a Spirit of Perſecution then prevailing; yet, as a Phyſician, they will perpetuate his Name to all ſucceeding Ages: Since, in the fifth Book of the former of theſe Works, which treats of the Holy Spirit, thoſe Paſſages were found, that al-

* His *Opera Medica*, &c. were printed Colon Allobrog. 1630, Folio. His *Depulſio Veſani cujuſdam*, &c. was printed Pariſ. 1561, Octavo. His Piece, *De Menſibus Mulierum*, Venet. 1556, Octavo; Baſil. 1556. His Piece intituled, *Ordo, & Ratio Ordinis in Legendis Hippocratis & Galeni Libris*, Pariſ. 1561, Octavo.

moſt amount to a Demonſtration that he was better acquainted with the Doctrine of the Circulation of the Blood, than any preceding Author.

" There are, ſays he, in the human Body Spi-
" rits of three different Kinds; the natural, ani-
" mal, and vital; which are really not three, but
" two, diſtinct Spirits. The vital is that which
" is communicated, by Anaſtomoſes, from the
" Arteries to the Veins; in which it is called na-
" tural: The Blood, therefore, is firſt; whoſe
" Seat is in the Liver and Veins. The vital Spi-
" rit is ſecond; whoſe Seat is in the Heart and
" Arteries. The animal Spirit is third; which is
" like a Ray of Light, and has its Seat in the
" Brain and Nerves."

Now to underſtand how the Blood is the Life, he ſays, " We muſt firſt underſtand the ſubſtan-
" tial Generation of the vital Spirit, which is
" compounded of, and nouriſhed by, inſpired Air
" and the ſubtileſt Part of the Blood. The vital
" Spirit has its Original in the left Ventricle of
" the Heart, by the Aſſiſtance of the Lungs,
" which chiefly contribute to its Generation. It
" is a ſubtil Spirit wrought by the Force of Heat,
" of a florid Colour, having the Power of Fire;
" ſo that it is a Sort of ſhining Vapour, made of
" the purer Part of the Blood, containing within,
" in itſelf, the Subſtance of Water, Air, and Fire.
" It is made in the Lungs by the Mixture of in-
" ſpired Air with that elaborated ſubtil Blood
" which the right Ventricle of the Heart commu-
" nicates to the left. Now that this Communi-
" cation is not made thro' the Septum of the
" Heart, as is commonly believed; but the ſub-
" til Blood is very artificially agitated by a long
" Paſſage thro' the Lungs, from the right Ven-
" tricle of the Heart, and is prepared, made flo-
" rid by the Lungs, and transfuſed out of the

" arte-

" arterious Vein into the venous Artery; and, at " laſt, in the venous Artery itſelf; it is mixed " with the inſpired Air, and, by Expiration, " purged from its Dregs: And thus, at length, " the whole Mixture is attracted, by the Diaſtole " of the Heart, into the left Ventricle, being now " a fit Subſtance out of which to form the vital " Spirit.

" Now that this Communication and Prepa- " ration is made by the Lungs, is evident, from " the various Conjunction and Communication " of the arterious Vein with the venous Artery in " the Lungs: The remarkable Largeneſs of the " arterious Vein likewiſe confirms it, ſince it " would never have been made of that Form and " Bulk; nor would it have emitted ſo great a " Quantity of very pure Blood out of the Heart " into the Lungs, if it had been only for their " Nouriſhment; nor would the Heart have been " this way ſerviceable to the Lungs, ſince the " Fœtus in the Womb is otherwiſe nouriſhed, by " reaſon of the Cloſeneſs of the Membranes of " the Heart, which are never opened till the " Birth of the Child, as GALEN teaches: So that " the whole Mixture of Fire and Blood is made " in the Lungs, where there is a Transfuſion out " of the arterious Vein into the venous Artery, " which GALEN took no Notice of."

Afterwards he ſays, that " This vital Spirit is " tranſmitted, from the left Ventricle of the " Heart, into the Arteries of the whole Body; " ſo that the more ſubtil Parts get upwards, where " they are yet more refined, eſpecially in the " Plexus Retiformis, which lies in the Baſe of the " Brain; where, from vital, it begins to become " animal, and approaches the proper Nature of " the rational Soul."

The Circulation of the Blood, is a Diſcovery of ſuch Importance, that every one, who gives the remoteſt Hints of it, has ſome Party to take him by the Hand, and canonize him as the firſt Diſcoverer.

Thus HIPPOCRATES, GALEN, and a great many more, have had their reſpective Champions, in this Particular, who have pronounced boldly, either one Way or the other, juſt as Whim and Caprice directed them. But as ſuch a Turn of Mind is a Diſgrace to Philoſophy, and a Reproach to human Nature, whoſe Glory and Dignity conſiſt in ſhaking off Prejudice, and adhering inviolably to Truth, wherever it can be found; ſo we will not abſolutely pronounce, that SERVETUS knew the Doctrine of the Blood's Circulation: But it is certain, that the firſt Step, made to this noble and uſeful Diſcovery, was, the finding that the whole Maſs of Blood paſſes thro' the Lungs by the pulmonary Artery and Vein.

Now that SERVETUS had a pretty diſtinct Idea of this Matter, is ſufficiently plain, from the foregoing Paſſages; but he talked in too vague and indetermined a Manner, to be eſteemed a full and unconteſted Diſcoverer.

REALDUS COLUMBUS was a Native of Cremona. He flouriſhed about the Year 1544, and was intimate with VESALIUS, whoſe public Lectures he had frequently an Opportunity of hearing. He is charged by ſome with want of Gratitude to VESALIUS, from whom he is ſaid to have ſtolen every Thing that is valuable in his own Works: But others maintain, that he had a clearer Idea of the Parts than VESALIUS, and deſcribed them more accurately; and it is certain, that his Latin is very pure.

He was the firſt who wrote diſtinctly and accurately about the Caruncles in the Vagina Mulie-

bris;

bris; alſo the firſt who mentions the Duplicature of the Peritonæum; and affirmed, that the Pleura was every-where double. He aſſumes to himſelf the Diſcovery of the Tunica Innominata of the Eye, and accuſes all his Predeceſſors of Ignorance in that Point. But DOUGLAS thinks, that the Tunic of the Eye which GALEN deſcribes under the Name of Tunica Sexta, is the very ſame he means.

He alſo boaſts of his having firſt diſcovered the third Bone ſubſervient to Hearing; and affirms of VESALIUS, that he not only deſcribed, but publickly diſſected, the Tongue, Larynx, and Eyes, of Oxen, inſtead of thoſe of Men; and that he himſelf was an Eye-witneſs of the Impoſture.

As GALEN and VESALIUS exceeded in the Number of the Muſcles of the Eye, ſo COLUMBUS is as remarkably deficient in that Point; ſince he determines, that there are only five.

The Uſe by him aſcribed to the Lungs deſerves to be taken Notice of: For he thinks, that they were beſtowed on Animals for this Purpoſe; that the Blood and vital Spirit might be prepared and generated in them. For he thinks, that the Blood, being attenuated, by Elaboration, in the right Sinus of the Heart, is carried thro' the Vena Arterioſa to the Lungs; where, by their continual Motion, it is agitated, ſtill farther attenuated, and mixed with that Air which is drawn in thro' the Noſtrils and Mouth, and carried thro' the Rami of the Aſpera Arteria to the Whole of the Lungs; which Air is itſelf prepared by this Colliſion: So that the Blood and Air, being thus mixed, are received into the Rami of the Arteria Vena, and at laſt carried, thro' the Trunk itſelf, to the left Ventricle of the Heart; from which they are carried thro' the Aorta, in every Direction, to all Parts of the Body.

Since this Opinion is largely inſiſted on by MICHAEL SERVETUS, we have Reaſon to ſuſpect, that COLUMBUS borrowed it from him. This alſo GALEN had advanced long before SERVETUS, when he ſays, that, when the Thorax is contracted, the venous Arteries, which are in the Lungs, being on all Hands pent up and compreſſed, quickly throw out the Spirit contained in them; but that they receive ſome Portion of Blood from the Vena Arterioſa by minute and inviſible Orifices*.

JOHANNES VALVERDA was a Phyſician, Native of Spain, and Pupil of REALDUS COLUMBUS. He is ſaid to have carried the Knowledge of Anatomy from Italy by Spain, and publiſhed the Tables of VESALIUS, with their Deſcriptions, ſomewhat enlarged in the Spaniſh Language, and added four new Figures to them: The firſt of which exhibits the Direction and Progreſs of the Fibres which compoſe thoſe Muſcles that cover the fore Part of the Body; the ſecond repreſents a Woman big with Child; the third and fourth give us a Proſpect of the cutaneous Veins, ſcattered up and down the anterior and poſterior Parts of the Body. But he is an Author of too ſmall Note, to be inſiſted on at greater Length; ſince the greateſt Character we find given him is, that he was rather to be commended for his Induſtry in propagating Anatomy, than for his writing well upon any Part of it.

GABRIEL FALLOPIUS was born at Modena in Italy, in the Year 1490. His Skill in Phyſic and Anatomy has made him univerſally admired. DOUGLAS, in his *Bibliographia Anatomia*, has

* His Works were printed under the Title of, *Realdi Columbi in Almo Gymnaſio, Patavino Anatomici Celeberrimi, de re Anatomica Libri Quindecim*, Venet. 1559, Folio; Pariſ. 1572, Octavo; Lugd. Bat. 1667, Octavo.

beau-

beautifully drawn his Character, when he ſays, that he was "*In docendo maxime Methodicus, in* "*Medendo feliciſſimus, in ſecundo expeditiſſimus*;" "Moſt judicious and methodical in his Method "of teaching, moſt ſuccefsful in his Practice; "and moſt expeditious in his Diffections."

He died in 1563, in the 73d Year of his Age, after having illuſtrated Anatomy, and enriched it with ſeveral Things unknown to former Ages.

He affirms, in particular, that the Muſculi Pyramidales were firſt diſcovered by him; and he is of Opinion, that the Bladder is compreſſed by them: But this was obſerved, before him, by GALEN and JACOBUS SYLVIUS.

He boaſts of his being the firſt who ſolved the perplexing Difficulty of ORIBASIUS, or rather of GALEN, concerning the Motion of the ſuperior Eye-lid, after the Muſculus Orbicularis is cut off. For he affirms, that, in the Year 1753, he diſcovered the Muſcle that raiſes the ſuperior Eye-lids. But GALEN himſelf ſolves this Difficulty, at a Time when he was become venerable for his Age and Experience, that is, when he digeſted the *Commentaries de Locis male affectis*; as will evidently appear to any one who reads them. Beſides, AVICENNA clearly deſcribes this Muſcle*. The ſame Muſcle is likewiſe accurately deſcribed by REALDUS COLUMBUS, in his anatomical Works, Anno 1559.

Tho' he is eſteemed the Diſcoverer of that ſeminal Duct which he calls the TUBA UTERI, whoſe Extremity, in which there is a large Aperture, is lacerated and fringed, as it were, like the Edges of old worked linen Cloth; yet it is excel-

* Lib. 1. Sum. 2. De Muſculis, Cap. 5.

lently

lently deſcribed by HEROPHILUS and RUFUS EPHESIUS, who lived long before him.

By the true Neck of the Womb, he means all that Part from its internal Orifice till it begins to enlarge itſelf, and grow wider: But the Whole of that Paſſage into which the Penis enters, is by him called SINUS and PUDENDUM MULIEBRE*.

BARTHOLOMÆUS EUSTACHIUS was a Native of Italy, and a Man of very extenſive Learning. His Tables, it is to be preſumed, have made his Character, as an Anatomiſt, ſufficiently known where Learning is countenanced, or even heard of. He enriched Anatomy with ſeveral Diſcoveries; for he firſt diſcovered the Glands that lie upon the Kidneys.

He finds Fault with VESALIUS for deſcribing, diſſecting, and delineating, the Kidney of a Dog, inſtead of that of a Man, without ſo much as taking Notice of the Difference.

He maintained, that the Duct of the renal Veins is oblique, and not tranſverſe, as is delineated by VESALIUS; and exhibited, in a moſt beautiful Figure, the Canaliculi Urinarii, which he compares to very ſmall Hairs; but which were before deſcribed by NICOLAUS MASSA.

In his Examination of the Bones he ſays, the true Structure of the viſory Nerve was firſt diſcovered by himſelf; and adds, that, when it is immerſed in Water, it is expanded into a large Membrane, like a very thin linen Cloth.

* His *Obſervationes Anatomicæ* were printed Venet. 1561, Octavo; Pariſ. 1562, Octavo; Helmſt. 1588, Octavo. His *Expoſitio in Librum Galeni de Oſſibus*, was printed Venet. 1570, His *Lectiones de Partibus ſimilaribus humani Corporis*, were publiſhed Norimberg. 1575, Folio. His *Compendium de Anatome humani Corporis*, appeared Patav. 1585, Octavo; Venet. 1571. His *Opera Omnia*, Venet. 1584, Folio; Francof. 1600, Folio.

Con-

Concerning the third Bone of the internal Ear, called STAPES, he has theſe Words: " I am conſcious to myſelf, that, without either Inſtruction or Information from any one, I knew that Bone long before they wrote; and that I ſhewed it to many in Rome, and cauſed it to be engraved on Copper."

He was the firſt who gave an accurate Deſcription of the thoracic Duct, or the Paſſage by which the Chyle is conveyed to the Heart, which he ſays, in Horſes, reſembles a white Vein, and has a ſemi-circular Mouth, opening into the internal jugular Vein.

He was the firſt who obſerved the Valve at the Orifice of the Vena Coronalis in the Heart; and boaſts of having firſt diſcovered, and exactly deſcribed, that Valve which is by ſome called VALVULA NOBILIS, in the Vena Cava, near the right Auricle of the Heart; tho' JACOBUS SYLVIUS ſeems to have obſerved it before him*.

VOLCHERUS COITER was born at Groningen, in the Year 1534, and, in Proceſs of Time, acquired a very great Character, as a Phyſician, Surgeon, and Anatomiſt. In his Introduction to Anatomy, Chap. 6. he gives good Advice to ſuch as are deſirous of making quick and regular Advances in their anatomical Studies.

Anatomy is conſiderably indebted to this Author for his Labour and Induſtry; for he clearly ſpecifies the firſt Origin of the Bones, accounts

* In his Treatiſe, *De Renibus*, he makes mention of the Glands of the Larynx. His *Opuſcula Anatomica* were printed Venet. 1563, Quarto; his *Libellus de Dentibus*, Venet. 1563, Quarto; his *Epiſiola Nuncupatoria*, Romæ, 1562; his *Opuſcula cum Annotationibus*, Venet. 1574, Quarto; Lugd. Batav. 1707, Octavo; and his *Tabulæ Anatomicæ* were publiſhed, by JO. MARIA LANCISI, Romæ 1714, Folio; and afterwards Amſtelod. 1722, Folio; then Romæ 1728, Folio; and lately by ALBINUS.

His Notes upon EROTIAN were publiſhed Venet. 1566.

for

for their Growth, and points out the Difference between thoſe of Infants and Adults: For he uſed to prepare Skeletons of Children, compare their Bones with thoſe of Adults, and demonſtrate the Difference between them to his Pupils in Bologna; where, in his own Houſe, he exhibited an abortive Fœtus, as long as a Finger, and furniſhed with all the Parts of a human Body. He alſo makes mention of another that he ſaw at Bologna, in the Houſe of Dr. ARANTIUS.

In his *Tractatus de Auditus Inſtrumento*, he has theſe Words: "What FALLOPIUS called the "Tympanum, he chiefly took from the Ears of "Brutes, and ſuch Animals as chew the Cud; "for theſe have this Paſſage formed like a certain "Species of Sea Shell, or a Turkiſh Drum; "whereas, in Man, this Paſſage is vaſtly different "from the Shape of a Drum."

For this Reaſon he thinks, that this Paſſage, or the ſecond Cavity, receives its Denomination of Tympanum, rather from its Uſe, than its Form. He maintains, that there are two of theſe Cavities: "For, ſays he, immediately behind the "Myringa (by which he meant the Tympanum), "in the upper and fore Parts, appears a Cavity, "which is at firſt narrow, but afterwards, dilating "itſelf, is ſtretched backwards towards the upper "Parts; and this Part is ſpongy and fungous, "and ſeems to have a Communication with the "internal Space of the Proceſſus Mamillaris."

According to him, two of the Officula Auditus, that is, the two largeſt, are full of ſmall Holes, which are filled with a medullary Subſtance; but the third contains none, on Account of its exceeding Smalneſs.

He ſays, that there are two Muſcles of the internal Ear, aſſigned by ſome, but he does not deſcribe them.

To

To the Muſcles belonging to the Face he adds ſome others, which, by later Authors, are called the MUSCULI CORRUGATORES; but, from their principal Office, ſhould rather be ſtyled MUSCULI SUPERCILIORUM DEPRESSORES; which he firſt diſcovered, and accurately deſcribed, but gave them no Name. He adds, "You will alſo ob-"ſerve, under the internal Skin of the Lips and "that of the Root of the Tongue, many fleſhy "Glands, under which are found Fibres riſing up-"wards from their Sides, in an oblique Direction; "and theſe, to me, ſeem to draw the under Lip "inwards*."

JULIUS CÆSAR ARANTIUS, born at Bologna, was the Pupil of VESALIUS, as alſo of his Uncle BARTHOLOMÆUS MAGUS, who taught him the Elements of Anatomy in the Year 1548. His Piece intituled, *De humano Fœtu Opuſculum*, was printed Venet. 1571, Baſil. 1579, Octavo; Venet. 1587, Quarto. To this Edition he joined a Preface, and a Book of anatomical Obſervations, printed Venet. 1595.

In the firſt Chapter of the laſt Edition of this Book he deſcribes the true and genuine Subſtance of the Uterus; aſſerting, that it is fungous, and bears a Reſemblance to a Sponge: That it is not ſingle, but diviſible into many Laminæ, like certain Fungi that grow under Trees; and that it is perforated with Holes, like a Sponge, or Pumice Stone.

In the third Chapter he not only accurately deſcribes the Veſſels of the Uterus, but alſo main-

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* His Piece intituled, *De Cartilaginibus Tabulæ*, was printed Bonon. 1566, Folio; his *Externarum, atque internarum, principalium humani Corporis, Tabulæ*, &c. Norimberg. 1573, Folio; Lavanii, 1653, Folio; his *Lectiones Gabrielis Fallopii, de Partibus ſimilaribus humani Corporis, ex diverſis Exemplaribus, Summa cum diligentia collectæ*, &c. were printed Norimberg. 1575, Folio.

tains,

tains, that its Arteries are continued to the Veins; which he alſo takes to be the Caſe with all the Arteries and Veins in the human Body; which is the ſame as if, with later Authors, he had maintained, that the Veins were no more than Arteries returning to the Heart.

The ſpermatic and hypogaſtric Arteries, which he calls the deſcending and aſcending ones, not only unite, and are continued together; but the Veſſels of the right Part of the Uterus are intermixed with thoſe of the left.

And in the fourth Chapter he treats largely and accurately of the Coalition of the Veſſels in the Heart of a Fœtus. "A few Days, ſays he, "after their Birth, there is a Coalition of this "Foramen; tho', even in older Subjects, ſome "remaining Marks of that Agglutination are al-"ways retained."

He alſo makes mention of another Coalition in the Liver, that of the Vena Portæ, with the Vena Cava, which is now univerſally called Ductus Venosus.

That white and riſing Part of the Baſis of the Ventricles of the Brain which is ſtretched forwards, on both Sides, in a longitudinal Direction, to the Forehead, he calls Pedes Hippocampi.

He ſays, that the Muſcles of the Eye ariſe from the Os Sphenoïdes, hard by the Foramen, thro' which the optic Nerve paſſes; but that one of the oblique Muſcles, or that called Musculus Brevis, ariſes from a certain Suture, or Cleft, that divides the Bones of the Maxilla Superior from the Oſſa Mali.

He alſo aſſerts, that the Muſculus Palpebræ Superioris, deſtined for opening the Eye, and riſing alſo from the Os Sphenoïdes, was known to him in the Year 1548; firſt obſerved the interior Chink of the Larynx, accurately deſcribed it, and ap-

appoſitely enough compared it to the Clefts in muſical Wind Inſtruments.

Tho' he does not openly acknowledge the Circulation of the Blood, yet he largely ſpecifies all the Arguments that are calculated for deſtroying the Hypotheſis of the Antients concerning a Tranſudation thro' the Septum, or Partition that divides the Ventricles of the Heart.

He firſt obſerved, that the Duct of the Artery of the Spleen was oblique, and twiſted in Form of a Snake; was the firſt who aſſerted that the middle Subſtance of the Urethra, or of the Canal common to the Urine and Semen, was of the ſame Structure with the Penis itſelf, and capable of being diſtended and becoming flaccid; and firſt took Notice of an orbicular Muſcle, ſurrounding, on all Sides, the Sinus Muliebris: But this Diſcovery was owing to JACOBUS CARPUS, who had before deſcribed the whole Neck of the Uterus as a muſcular Subſtance.

According to him, the Muſculi Recti of the Abdomen ariſe, with a muſculous Origin, from the Pubes, when their Covering (he means their Muſculi Pyramidales) are wanting; and maintains, that the Portion of the Muſculus Biceps, which, according to VESALIUS, ariſes from the Proceſs of the Acromion, and is inſerted into the Humerus, is the eighth Muſcle of the Humerus, which was afterwards, by RIOLAN, called CORACO-BRACHIÆUS. But it is, without Reaſon, by ſome called NONUS HUMERI PLACENTINI; ſince it is, in Reality, the Diſcovery of ARANTIUS.

He likewiſe diſcovered the Indicator, or Indicis Extenſor Proprius, which had remained unobſerved before him; and maintained, that the ſecond Muſcle of the Fingers, by which he means what is now called the Flexor Perforans, was the In-

Inſtrument of bending all the Inter-nodes, and not of the third Joint only, as his Predeceſſors had maintained.

He aſſumes to himſelf the Diſcovery of the Muſculus Femur Circumagens, which he calls the twelfth: He likewiſe obſerves, that a Portion of the Muſculus Femoris Primus, that is, of the Glutæus Maximus, becomes a membranous Tendon, which, joining wlth another Tendon, ariſing from the ſixth Muſcle of the Tibia, or Faſcialis, is ſtrongly and laterally inſerted into the Appendix Tibiæ. By means of this Communication, he accounts for the Pains of the Hips reaching to the Knee.

In his *Obſervat. Anatom.* Cap. 16. he has theſe Words, concerning the Subſtance of the Teſticles: "Perfect Semen is carried, as it were, from numberleſs ſmall Roots of a Plant, variouſly diſperſed thro' the Subſtance of the Teſticles, which Roots appear wrapped up and curled like the Tendrils of Vines, and reſemble white curled Hair."

Constantius Varolius was a Native of Bologna; an accurate Philoſopher, an expert Surgeon, and a ſkilful Anatomiſt. He is ſaid to be the firſt who diſcovered the Valve of the Colon, and elegantly deſcribed it, in the following Words: "Where the Ilium is joined to the Colon, there riſes, in its inner Part, a certain Membrane, being the laſt Boundary of the Ilium, which reaches ſo far, and which I, its firſt Diſcoverer, call the Operculum Ilii." And, a little after, he makes mention of the "Appendix of the Colon as being an oblong Sack, imperforated at one of its Extremities, which is called the Intestinum Cæcum." He firſt divided the Brain into three Parts, by adding the Beginning of the ſpinal Marrow, whilſt yet contained within

within the Skull, and giving Birth, as it were, to the Nerves, whoſe Origin was formerly thought to be the Brain.

The Optic Nerve, according to him, ariſes from the poſterior Part of the ſpinal Marrow, and not from the Baſe of the Brain, in its anterior Part, as GALEN, and others, maintained.

The tranſverſe Proceſs of the Brain is called PONS VAROLII, from VAROLIUS, its firſt Diſcoverer. He firſt diſcovered the Glands in the Plexus Choroïdes.

SALOMON ALBERTUS was Profeſſor of Phyſic at Wirtemberg, and publiſhed a Book intituled, *Hiſtoria Plerarumque Corporis humani partium, in Uſum Tyronum*, Wittebergæ, 1583, 1602, 1630, Octavo.

The Diſcovery of the Valve of the Colon, commonly called VALVULA BAUHINI, is juſtly aſcribed to him: For he affirms, that he firſt diſcovered it in a Beaver, and then in a Man.

His three Orations, *De Diſciplina Anatomica*, were printed Nirembergæ, 1585, Octavo; and his *Obſervationes Anatomicæ*, Wittebergæ, 1620, Octavo.

ARCHANGELUS PICCOLHOMINUS was a Native of Ferrara, and Citizen of Rome. He was born in the Year 1526, but, in RIOLAN's Opinion, he was rather a Philoſopher than an Anatomiſt, ſince his anatomical Prelections are interſperſed with phyſiological Diſquiſitions, and fine-ſpun Controverſies, quite foreign to Anatomy. But that he laboured with Succeſs, in this Branch of Learning, is ſufficiently evident, from the Improvements and Diſcoveries he has made in Anatomy*.

* His *Anatomiæ, ſive de reſolutione Corporis humani, Libri Quatuor*, &c. was printed Patav. 1573, Octavo; Francof. 1591, Octavo.

He was the firſt who divided the Subſtance of the Brain into cineritious and medullary; for he calls that concretious or whitiſh livid Body, that firſt appears, the Brain itſelf: But he calls that ſolid white Body, which is wrapped up in it, the Medulla, or Marrow which he diſtinguiſhes into three Kinds; the MEDULLA GLOBOSA, MEDULLA OBLONGATA CAUDICIS INSTAR, and MEDULLA SPINALIS.

He maintains, that all the Nerves have their Origin from the Medulla Oblongata; and was the firſt who called the Proceſſus Mammillares NERVI ODORATORII, or the Nerves by which the Senſation of Smelling is produced.

He firſt diſcovered that wonderful Contrivance of Nature at the Beginning of the Inteſtinum Cæcum; that is, three Valves, like little Doors, opening downwards; and aſſerted, that they were deſigned to prevent the Return of the Fæces.

He alſo firſt delineated the Anaſtomoſis of the Vena Portæ and the Vena Cava within the Liver, after it had been deſcribed by JACOBUS CARPUS; aſcribed Proſtatæ to Women, as GALEN had done before him; was the firſt who deſcribed the particular Membrane of the Fat which RIOLAN afterwards called MEMBRANA ADIPOSA; aſſerts, that the Peritonæum is every where double, and conſiſts of two Laminæ; and firſt took Notice of, and deſcribed, that Line of the Abdomen which is now called LINEA ALBA.

In his Opinion, there was only one continued Duct that reached from the Mouth to the Anus; and affirms, that the internal Tunic of the Inteſtines is three Times as long as the external one; and that it is corrugated, and formed into Wrinkles, that the Chyle, by that Means, remaining longer in them, might be the more commodiouſly extracted by the meſenteric Veins.

He

He deſcribes the membranous Canals, or Tubes with a fleſhy Covering, thro' which the Urine is ſtrained, better than CARPUS or MASSA.

The Reaſon he aſſigns why the left ſpermatic Vein does not ariſe from the emulgent, is preciſely the ſame which is embraced by the Moderns.

He calls the Hymen, CLAUSTRUM VIRGINITATIS; and aſſigns Names to all the Muſcles, from the Uſes and End for which Nature deſigned them. Thus he named the MUSCULI OCULARII, or VISORII; MASTICATORII; LOCUTORII; RESPIRATORII; AMPLEXATORII; SCAPULARII; HUMERARII; CUBITARII; APPREHENSORII, or MANUM MOVENTES; AMBULATORII, or PROGRESSORII; FERNERALES; TIBIALES, &c.

He called the frontal Muſcles, MUSCULI PATHEMATIUM, or MUSCULI ANIMI AFFECTUUM SIGNIFICATIVI *.

CASPARUS BAUHINUS was born at Baſil, in the Year 1560, and was univerſally eſteemed to be a ſkilful Anatomiſt, and curious Botaniſt: But RIOLAN ſpeaks of him as ignorant, injudicious, and preſumptuous. He ſays, that, in the Year 1579, he obſerved the Valve in the Beginning of the Ilium, or Colon, before he read any Author who made mention of it. But it is certain, that VAROLIUS, and a great many others, deſcribed it, very accurately, many Years before.

He took Notice of the natural Narrowneſs of the Inteſtinum Colon in the right Side; and for this Reaſon colic Pains not only ariſe moſt frequently, but rack moſt violently, in that Part: For that narrow Paſſage is eaſily obſtructed by the

* His *Anatomicæ Prelectiones* were printed Romæ 1586, Folio; and his *Commentarii in Librum Galeni de Humoribus*, Pariſ. 1556, Octavo.

Excrements, which are long retained there, and indurated*.

JOHANNES POSTHIUS was born, in the Year 1537, in Germerſheim, a Town of the lower Palatinate upon the Rhine; and died, in the ſixtieth Year of his Age, in the Year 1597. He ſeems to be very dextrous at diſſecting the Muſcles, which is ſufficiently proved, by ſome Diſcoveries he has made.

He maintains, that there are four Muſcles which draw the Lips inwards to the Teeth; two in the inferior, and two in the internal Part; aſcribes ſix Muſcles to the Penis; and affirms, that there is only one Muſcle between the Cartilages of the Ribs, and not two, as in the intercoſtal Spaces.

He ſays, that the fourth Muſcle of the Maxilla Inferior does not ariſe from the Styloïd, but from the mammillary Proceſs; and was the firſt who aſſerted, that the tendinous Part of this Muſcle adhered to the Os Hyoïdes. He alſo aſſerts, that the Proceſſus Mammillares are not the Organs of Smelling; and adviſes, to diſſect the Muſcles as much as poſſible, in ſuch a Manner, as to preſerve their Origins and Inſertions entire; becauſe, by this means, their Uſes may be moſt commodiouſly diſcovered†.

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* His Piece intituled, *De Partibus humani Corporis externis Liber*, was printed Baſil. 1588; his *Anatomes Liber Secundus*, ibid. 1591, Octavo; his *Anatomica Corporis Virilis & Muliebris Hiſtoria*, Lugd. Bat. 1597, 1609, Octavo; his *De Corporis humani Fabrica, Lib. 4to*, &c. Baſil. 1600, Octavo; his *Theatrum Anatomicum*, Francof. 1605, Octavo; ibid. 1621, Quarto; his *Inſtitutiones Anatomicæ*, &c. Baſil. 1604, 1609, Octavo; 1640, Quarto; Francof. 1616, Octavo; Oppenhemii, 1614, Octavo; 1629, Octavo; his *Epiſtola Anatomica Curioſa*, Lipſ. & Franc. 1673, Quarto.

† His *Obſervationes Anatomicæ* were prtnted Francof. 1590, 1593, Octavo: his *Mantiſſa Anatomica* was printed Hafniæ 1661, Octavo.

AN-

Andreas Cæsalpinus, born at Arezo in Italy, was a ſtrong Champion for the Peripatetic Doctrine, in Oppoſition to Galen, who was, at that Time, reverenced as an Oracle. Hence it was, that the Writings of Cæsalpinus, tho' very valuable in themſelves, were neglected; and thoſe Paſſages which he caſually wrote, concerning the Circulation of the Blood, either not adverted to, or not underſtood, by any, till Harvey publiſhed his Treatiſe on the Subject.

Cæsalpinus affirms, with Aristotle, that the Heart is not only the Source and Origin of the Arteries and Veins, but alſo of the Nerves.

In Queſt. 4. where he proves, that, in Reſpiration, no external Air can have Acceſs to the Heart; he has theſe Words: "For the Membranes are ſo fitted and adapted to the Mouths of the Veſſels, that, when the Heart is dilated, they are opened; but, when it is contracted, they are ſhut."

Here he alſo clearly and fully explains the Contraction and Dilatation of the Heart.

"Some of the Veſſels, continues he, which terminate in the Heart, ſend their Contents into it; ſuch as the Vena Cava, into the right Ventricle, and the venous Artery into the Left: Some of them, on the other Hand, draw their Contents from it; as the Arteria Aorta from the left Ventricle, and the arterious Vein from the right; but they all have Membranes ſo fitted and adapted to them, that the Mouths of the intromitting Veſſels will not admit of a Return, and the eliminating Veſſels will not admit of an Intromiſſion. It happens, that, when the Heart is contracting, the Arteries are dilated; and, when it is dilating itſelf, they are contracted."

For when the Heart is dilating, it ſhuts the Orifices of the eliminating Veſſels, ſo that nothing can, at that Time, flow from the Heart into the Arteries; and, when it is contracting, its Contents muſt flow into the Veſſels, becauſe the Membranes are then opened.

He maintains, that the Pulſation of the Heart and Arteries proceeds from an Efferveſcence of Humours in the Heart; and he treats largely of the Pulſe.

Soon after, he has theſe Words: "The Lungs, "therefore, drawing the hot Blood from the right "Ventricle of the Heart, by a Vein reſembling "an Artery, and by Anaſtomoſis returning it to "the venous Artery that goes to the left Ventricle of the Heart; the freſh Air is, in the "mean Time, tranſmitted thro' the Canals of "the Aſpera Arteria."

Realdus Columbus had advanced the ſame before him.

"The ſeveral Phænomena, appearing upon the "Diſſection of a Subject, correſpond excellently "with this Circulation of the Blood, from the "right Ventricle of the Heart, thro' the Lungs "to the left Ventricle."

And, a little after, he, with a great deal of Learning, proves, that the Antients had no manner of Reaſon for giving the Names of Arteria Venosa, and Vena Arteriosa, to the Veſſels that bear theſe Names; ſince, in his Opinion, one of them was an Artery, and the other a Vein.

In his fifth Queſtion, where he ſhews that the Heat of the Heart is the Principle of Motion in Reſpiration, he has theſe Words: "The ſame "hot Blood which, by dilating the Heart, cauſes "the Pulſe; is alſo, by dilating the Lungs, the "Cauſe of Reſpiration."

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The Lungs, then, being enlarged, the external Air muſt neceſſarily ruſh into the Aſpera Arteria; which Inſpiration is, for that very Reaſon, called Refrigeration; and a Diminution of Bulk happens, juſt as in boiling Liquors, when cold ones are poured into them: But when the Lungs collapſe, the Air muſt neceſſarily be returned; which is called Expiration.

In his ſixth Queſtion he endeavours to prove, that no Part, in which there is not Blood, can be capable of Senſation. But tho', in his Opinion, there can be no Senſation without a Nerve; yet it is not the Nerve that feels, but the Fleſh, or Part, in which the Blood is contained.

" The Contrivance of Nature, ſays he, in animal Motion, reſembles that of Organs, which, by means of the Air, communicated to the Pipes, and by touching ſometimes one, and ſometimes another Key, produce the various Combinations of Sounds intended by the Organiſt."

In the ſeventeenth Queſtion of his ſecond Book he ſays, that Suffocation, in a Quinſey, is rather produced by the Repletion of the jugular Veins, than the ſhutting up the Mouth of the Larynx: For when the Veins of the Neck are ſo obſtructed that the Blood and Spirits cannot aſcend, they muſt neceſſarily regurgitate to the Heart and Lungs; and the Lungs being filled, and becoming replete by this means, cannot contract and dilate themſelves.

In Page 234. he has theſe Words: " The Veins become turgid beyond the Ligature, and not betwixt it and the Heart; but it ought to have been otherwiſe, if the Motion of the Blood and Spirits had been from the Viſcera to the ſeveral Parts of the Body. For the Paſſage being obſtructed, the progreſſive Motion of the

" Blood is ſtopped, ſo that the Veins ſhould have " become turgid betwixt the Ligature and the " Heart."

Let us ſee whether this Difficulty is ſolved by what ARISTOTLE has ſaid, *Lib. de Somno*, Cap. 3. where he has theſe Words: " For that which is " evaporated, muſt neceſſarily be impelled to ſome " Part, and then transformed and changed in the " ſame Manner with that Arm of the Sea called " Euripus: For that which is warm in every Ani- " mal, has a Tendency to fly upwards; but when " much of it is lodged, at one and the ſame Time, " in the upper Parts, it then returns, and is car- " ried downwards." Thus far ARISTOTLE.

" For the underſtanding of which Paſſage we " muſt know, that the Paſſages of the Heart are " ſo contrived by Nature, that there is an Entry " from the Vena Cava to the right Ventricle of " the Heart, from which there is a Paſſage into " the Lungs; and that from the Lungs there is " another Paſſage into the left Ventricle of the " Heart, from which, at laſt, there is a Paſſage " into the Arteria Aorta, certain Membranes be- " ing fitted to the Mouths of the Veſſels, to " hinder the Return of the Fluids: For thus " there is a perpetual Motion from the Vena " Cava thro' the Heart and Lungs into the Ar- " teria Aorta.

" When we are awake, the Motion of the na- " tural Heat is towards the Surface of the Body, " which is the immediate Inſtrument of Senſation: " And ſince, during Sleep, it is towards the Heart; " we may ſuppoſe, that, in a waking State, many " Spirits, and much Blood, are conveyed into the " Arteries, and from thence carried into the " Nerves; but that, in Sleep, this ſame Warmth " returns to the Heart thro' the Veins, and not " thro' the Arteries: For there is a natural Paſ-

" ſage

" ſage to the Heart thro' the Vena Cava, but not " thro' the Artery. A Confirmation of this may " be had from the Pulſes of the Arteries, which, " in waking People, are high, vehement, quick, " frequent, and, in ſome Degree, vibratory; but " in Sleep they are low, languid, ſlow, and loiter- " ing: For, during Sleep, very little of the na- " tural Heat goes into the Arteries; and it ruſhes " into them with greater Violence when we awake: " But it is quite otherwiſe with the Veins; which, " during Sleep, become turgid, but leſſen, and " become ſmaller, when we are awake; as will " appear, by taking a View of thoſe in the Hand, " in theſe two different States. For the native " Heat, during Sleep, paſſes from the Arteries " into the Veins by a Communication of Orifices " called Anaſtomoſes, and from thence to the " Heart. But as the Flux of Blood towards the " upper Parts, and its Reflux to the lower, after " the Manner of EURIPUS, is manifeſt, both du- " ring a State of Sleeping and Watching; ſo the " Motion of it, in any Part of the Body, is very " ſenſible, when a Ligature is applied, or the Veins " are obſtructed any other Way. For when the " Paſſage is intercepted, thoſe Rivulets ſwell at " the very Part where they were uſed to flow ea- " ſily. Perhaps the Blood, on ſuch an Occaſion, " returns to its Source; leſt its Motion, being in- " tercepted, ſhould be quite deſtroyed."

Tho' CÆSALPINUS writes, as one would think, very explicitly upon this Matter; yet we will not take upon us to determine, poſitively, that he knew this Affair diſtinctly.

We rather think, with WOTTON, " That " this Notion had only been occaſionally and " ſlightly treated of by COLUMBUS and CÆSAL- " PINUS, who themſelves, in all Probability, did " not know the Conſequences of what they aſ- " ſerted;

" ſerted; and therefore it was never applied to " other Purpoſes, either to ſhew the Uſes of the " other Viſcera, or to explain the Nature of Diſ- " eaſes: Neither, for any Thing that appears at " this Day, had they made ſuch Numbers of Ex- " periments as were neceſſary to explain their " Doctrine, and to clear it from Oppoſition. All " this Dr. HARVEY undertook to do, and with " indefatigable Pains traced the viſible Veins and " Arteries throughout the Body, in their whole " Progreſs from and to the Heart, ſo as to de- " monſtrate, even to the moſt incredulous, not " only that the Blood circulates thro' the Lungs " and Heart; but the very Manner how, and " the Time in which, that great Work is per- " formed*."

This Author died at Rome in 1603.

HIERONYMUS FABRICIUS AB AQUAPENDENTE, ſo called from a Town in Tuſcany, where he was born, was Pupil to GABRIEL FALLOPIUS, then Profeſſor of Anatomy at Padua, whom he ſucceeded, in that Province, in the Year 1565; and continued in it upwards of fifty Years. He died at Padua in 1619.

In 1574, he firſt obſerved the Valves of the Veins, of which, it is ſaid, he was informed by Father PAUL; but he was not acquainted with their Structure or Uſes.

He diſcovered a ſmall Muſcle in the internal Ear, which he appropriates to the Malleus; and affirms, that the Cuticle conſiſts of two Laminæ. He was alſo the firſt who looked upon the carnous Tunic of the Bladder as a Muſcle concerned in the Expulſion of the Urine.

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* His *Quæſtionum Peripateticorum Libri Quatuor*, *Dæmonum inveſtigatio Peripatetica*, *Quæſtionum Medicarum Libri Duo*, & *de Medicamentorum Facultatibus*, were printed Venet. 1593, Quarto.

Be-

Beſides theſe Particulars, he has many others that deſerve Attention; and, upon the Whole, was an accurate Anatomiſt, and admirable Surgeon*.

JOHANNES PHILIPPUS INGRASSIAS, a Sicilian by Birth, and Profeſſor at Naples, flouriſhed about the Year 1546. He claims the Diſcovery of the Stapes, a ſmall Bone of the internal Ear; and is the firſt who deſcribes the true Structure of the Os Cribroſum†.

ANDREAS LARENTIUS was Profeſſor of Phyſic, Chancellor of the Univerſity of Montpellier, and Phyſician to HENRY IV. of France; died in the Year 1619.

His anatomical Works are more remarkable for Elegance of Style, than Correctneſs, with reſpect to the Subject; for he is ſaid to have made a great many Miſtakes, and to have laid Claim to many important Diſcoveries, which were, however, known to preceding Authors.

His Errors are ſaid, by RIOLAN, to be owing to his truſting to the Reports of others, without examining the Parts himſelf. His anatomical Works and Figures, notwithſtanding, have been in very good Repute‖.

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* His Works are, *De Viſione, Voce, & Auditu*, Venet. 1600, Folio; *Tractatus de Oculo Viſus Organo*, Patav. 1603, Folio; Francof. 1605---1613, Folio; *De Venarum Oſtiolis*, Patav. 1603, Folio; *De Locutione & ejus Inſtrumentis*, ibid. 1603, Folio; *De Muſculi Artificio, & Oſſium Articulationibus*, Vicent. 1614, Quarto; *De Reſpiratione, & ejus Inſtrumentis*, Patav. 1615, Quarto; *De Motu locali Animalium*, Patav. 1618, Quarto; *De Gula, Ventriculo, Inteſtinis Tractatus*, Patav. 1618, Quarto; *Opera Anatomica*, Francof. 1623, Patav. 1625; *Opera Omnia Phyſiologica & Anatomica*, Lipſ. 1687, Folio; *Opera Anatomica cum Præfatione Albini*, Lugd. Batav. 1738, Folio.

† His only anatomical Work is, *Commentaria in Galeni Librum de Oſſibus*, printed Panor. 1603, Folio; Venet. 1604, Folio.

‖ His Works are, *Hiſtor. Anatom. humani Corporis*, &c. Pariſ. 1600, Folio; Francof. 1600, Folio; 1602, 1616, 1627, Octavo; *Opera omnia Anatomica & Medica*, Francof. 1627, Folio; in French à Paris, 1646, Folio; *Opera Anatomica*, &c. Hanov. 1601, Octavo.

JOHN

John Riolan was born at Paris in the Year 1577, where he was afterwards Royal Profeſſor of Anatomy and Botany, and firſt Phyſician to Mary of Medicis, Mother to Lewis XIII.

He was an exceeding dextrous Anatomiſt, and elegant Writer; enriched Anatomy with many uſeful Diſcoveries, and appears well verſed in the Writings of the Antients.

Amongſt other Diſcoveries, he firſt took Notice of the Appendiculæ Pingues of the Colon, gave Names to the hepatic and cyſtic Ducts of the Liver, and obſerved, that the Ductus Communis was not furniſhed with a Valve, but, inſtead of that, with a kind of Rugoſity, which, in ſome Degree, ſupplies the Place of one.

With reſpect to the Hymen, he thinks it a circular Membrane, placed acroſs the Vagina, with a ſmall Foramen in the Middle; and that, by the Laceration of this, the Carunculæ Myrtiformes are formed.

He allows of the Anaſtomoſes of the epigaſtric and mammillary Arteries in Women, but not in Men; and has alſo ſome Obſervations, which are new, concerning the Canal of the Cervix Uteri, the Os Hyoïdes, Tongue, and a Ligament that is extended from the ſtyloïd Apophyſis to the Angle of the inferior Maxilla*.

Caspar Asellius was born at Cremona, and was Profeſſor of Anatomy at Pavia. He is celebrated for being the firſt, amongſt the Moderns,

* His Works are, *Schola Anatomica*, &c. Pariſ. 1607, 1609, Octavo; Genev. 1624, Octavo; *Anatome Corporis humani*, &c. Pariſ. 1610, Folio; *Oſteologia*, &c. Pariſ. 1614, Octavo; *Anthropographia*, Pariſ. 1618, Octavo; ibid. 1626, Quarto; *Opera Anatomica*, Lutet. Pariſ. 1649, Folio; *Opuſcula Anatomica*, Pariſ. 1652, Duodecimo; *Enchiridion Anatomicum*, &c. Lugdun. Batav. 1649, Pariſ. 1658, Octavo; Jen. & Lipſ. 1674, Octavo; Lugd. Bat. 1675, Octavo; Francoſ. 1677, Octavo; and in French à Lyon. 1682, Octavo.

who

who took Notice of the lacteal Veſſels in the Meſentery, which he deſcribes as conveying the Chyle to a large Gland ſituated in the Center of the Inteſtines; but this Account, he confeſſes, is taken from the Appearances in brute Subjects.

He modeſtly declines the Honour of this Diſcovery, becauſe he ſays that theſe Lacteals were known to HIPPOCRATES, ERASISTRATUS, and GALEN *.

WILLIAM HARVEY, a celebrated Phyſician, was born at Folkſtone in Kent in the Year 1577. He ſtudied five Years at Padua, where he took a Doctor's Degree; afterwards took the ſame Degree at Cambridge; and, having been Phyſician to King JAMES I. and King CHARLES I. and Preſident of the College of Phyſicians; he died in 1657, in the eightieth Year of his Age.

His Diſcovery of the Circulation of the Blood was of the utmoſt Importance, in Phyſic, of any that was ever made, and immortalized his Name: But as it has been frivolouſly diſputed, whether the Honour of it belongs to him, I ſhall tranſcribe a Paſſage from WOTTON's Reflections on Antient and Modern Learning, which ſets this Affair in a true Light.

" This Diſcovery, firſt made perfectly intelli-
" gible by Dr. HARVEY, is of ſo very great Im-
" portance to ſhew the Communication of all the
" Humours of the Body with each other, that,
" as ſoon as Men were perfectly ſatisfied that it
" was not to be conteſted, which they were in a

* This Diſcovery was made in 1622.

His Works are, *De Lactibus, ſeu Lacteis Venis, quarto Vaſorum, Meſeraicorum genere novo invento, Diſſertatio, cum Figuris elegantiſſimis*, Mediolan. 1627, Baſil. 1628, Lugd. Bat. 1640, Quarto; 1641, Octavo.

It is alſo extant with the Works of SPIGELLIUS, reviſed by Vander LINDEN, and in VESLINGIUS, illuſtrated by BLASIUS.

" few

" few Years; a great many put in for the Prize, " unwilling that HARVEY ſhould go away with " all the Glory."

At laſt, HARVEY printed a Diſcourſe, on purpoſe, upon this Subject, at Francfort, in 1628. This gave him a juſt Title to the Honour of ſo noble a Diſcovery; ſince what his Predeceſſors have ſaid before him was not enough underſtood, to form juſt Notions from their Words. One may alſo obſerve, how gradually this Diſcovery, as well as all abſtruſe Truths of human Diſquiſition, was explained to the World.

HIPPOCRATES firſt talked of the uſual Motion of the Blood; PLATO ſaid, that the Heart was the Origin of the Veins and Blood that was carried about every Member of the Body; ARISTOTLE alſo, ſomewhere, ſpeaks of a recurrent Motion of the Blood: Still all this was only Opinion and Belief. It was rational, and became Men of their Genius; but not having, as yet, been made evident by Experiments, it might as eaſily be denied, as affirmed.

SERVETUS firſt diſcovered, that the Blood paſſes thro' the Lungs; COLUMBUS went farther, and ſhewed the Uſes of the Valves of the Heart, which let the Blood in and out of their reſpective Veſſels, but not in the ſelf-ſame Road. Thus the Way was juſt open when HARVEY came, who built upon the firſt Foundations.

To make his Work ſtill the eaſier, the Valves of the Veins, which were diſcovered by Father PAUL the Venetian, had not long before been explained by FABRICIUS AB AQUAPENDENTE, when the Circulation was yet more clearly demonſtrated.

There was one Thing ſtill wanting, to complete this Theory; and that was, the Knowledge how the Veins received that Blood which the Arteries diſcharged.

1. It was believed, that the Mouths of each Sort of Veſſels joined into one another. That Opinion was ſoon laid aſide; becauſe it was found, that the capillary Veſſels were ſo extremely ſmall, that it was impoſſible, with the naked Eye, to trace them. This put them upon imagining, that the Blood ouzes out of the Arteries, and is abſorbed by the Veins, whoſe ſmall Orifices receive it as it lies in the Fibres of the Muſcles, or in the Parenchyma of the Bowels; which Opinion has been generally received by moſt Anatomiſts ſince Dr. Harvey's Time. But Leeuwenhoeck has found in ſeveral Sorts of Fiſhes, which were more manageable by his Glaſſes than other Animals, that Arteries and Veins are really continued Siphons, variouſly wound round each other towards their Extremities, in numberleſs Mazes, all over the Body; and others have found what he ſays to be very true, in a Water Newt: So that this Diſcovery has paſſed unconteſted.

And ſince it has been conſtantly found, that Nature follows like Methods in all Sorts of Animals, where ſhe uſes the ſame Sorts of Inſtruments; it will always be believed, that the Blood circulates in Men after the ſame Manner as it does in Eels, Perches, Carps, Bats, and ſome other Creatures, in which Leeuwenhoeck tried it: Tho' the Ways how it may be viſible to the Eye, in human Bodies, have not, that I know of, been yet diſcovered.

But Thomas Bartholine, and Consentine, have raiſed up a modern Rival to Harvey, for the Honour of the Diſcovery of the Circulation, which is the celebrated Father Paul. What they relate, amounts only to this; that, in a Manuſcript of Father Paul, that was left in the Hands of Father Fulgentius at Venice, the Particulars of the true Circulation of the Blood, as publiſhed by

by HARVEY, are contained: And hence they conclude, that he communicated it to FABRICIUS AB AQUAPENDENTE, who told it to HARVEY whilſt he was at Padua.

But the Truth of this Affair appeared to be, that, after HARVEY's Return to England, he made a Preſent of his Book, juſt then publiſhed, to the Venetian Embaſſador; who, immediately after going Home, lent it to Father PAUL, whoſe Curioſity led him to make ſome Extracts from it, which are contained in the Manuſcript above mentioned.

What made this Story the more likely to be true, was Father PAUL's Sagacity in anatomical Reſearches, who firſt obſerved the Contraction and Dilatation of the Pupil of the Eye; and is ſaid to have communicated to AQUAPENDENTE his Knowledge of the Valves in the Veins.

Beſides this Diſcovery of the Circulation, HARVEY made ſeveral with reſpect to the Generation of Animals*.

CASPAR BARTHOLINUS was a Dane, and born in the Year 1585. After viſiting moſt of the famous Univerſities, and attending the Lectures of the moſt celebrated Profeſſors, he was made Royal Profeſſor at Copenhagen; then turned his Studies to Divinity, and died in 1630, in the Forty-fifth

* His Works are, *Exercitatio Anatomice de Motu Cordis & Sanguinis in Animalibus*, Francof. 1628, Quarto; Lugd. Bat. 1639, Quarto; ibid. 1647; *Cum Refutationibus Æmilii Pariſiani*, 1647; Patav. 1643; it is likewiſe in a Book intituled, *Recentiorum Diſceptationes, de Motu Cordis*, &c. Lugd. Bat. 1647, Quarto; then it appeared in Engliſh, printed at Rotterdam, 1671; *Exercitationes duæ de Circulatione Sanguinis*, Roterod. 1649; *Epiſtola ad Johan. Dan. Horſtium de Inventis Aſellii & Pequeti*, are in the Decad of Medical Epiſtles of JOH. DAN. HORSTIUS. *Exercitationes de Generatione Animalium*, Lond. 1651, Quarto; Amſtel. 3651, 1652, Duodecimo; Hag. Comit. 1680, Duodecimo; in Engliſh at London, 1653.

Year

Year of his Age. He was contemporary with HARVEY *.

To CASPAR BARTHOLINE I ſhall ſubjoin his Son and Grandſon.

THOMAS BARTHOLINE, a Phyſician, was the Son of CASPAR BARTHOLINE, and born at Copenhagen in 1616. He was Profeſſor at the Place of his Birth, enriched Anatomy with many uſeful Diſcoveries, and claims the Glory of having firſt obſerved the lymphatic Veſſels: But the Pretenſions of OLAUS RUDBECKIUS, and JOLLIFFE, an Engliſh Phyſician, to the ſame Diſcovery, render his Title to it doubtful.

RUDBECKIUS publiſhed his Obſervations much about the ſame Time as thoſe of BARTHOLINE appeared; and Dr. JOLLIFFE ſhewed the ſame to ſeveral of his Friends, but without publiſhing any Thing concerning them. The Diſcoveries being undoubted, and all three working upon the ſame Materials, there ſeems no Reaſon to deny any of them the Glory of their Inventions. The Thing which they found was, that there are innumerable ſmall clear Veſſels in many Parts of the Body, chiefly in the Abdomen, which convey a colourleſs Juice either into the common Receptacle of the Chyle, or elſe into the Veins, there to mix with the Blood. He alſo claims a Title to the Diſcovery of the thoracic Duct; but this is alſo diſputed with him by Van HORNE and PEQUET †.

He

* His Works are in much Eſteem, which are, *Anatomicæ Inſtitutiones*, Albiæ 1661, Argentor. 1626, Roſtoch. 1626, Goſlar. 1632, Oxon. 1632. Theſe Inſtitutions were enlarged by BARTHOLINE the Son, and publiſhed in different Years and Places. They were publiſhed in the German Tongue, Hafn. 1648. *Controverſiæ Anatomicæ*, Goſlar. 1631; *Enchiridion Phyſicum*, Argent. 1652.

† His Works are, *Anatomia ex Caſpari Bartholini, Parentis Inſtitutionibus*, &c. Lugd. Bat. 1641, ibid. 1645, ibid. 1651; Hagæ Comitis 1655, ibid. 1660, ibid. 1663; Roterod. 1669, ibid. 1673;

 Ana-

He left two Sons, CASPAR and THOMAS; the former of whom publiſhed many of his Father's Works. He alſo wrote upon the Ovaries of Women, Generation, and the Structure of the Diaphragm; and is ſaid to have firſt diſcovered the inferior and leſſer ſalivary Ducts. He farther ſpeaks of a new Method of preparing the Viſcera for anatomical Uſes*.

Anatomica Aneuriſmatis diſſecti Hiſtoria, Panormi 1664; *De Lacteis Thoracicis, in Homine Brutiſque nuperrime obſervatis, Hiſtoria Anatomica*, Hafniæ 1652, Lond. 1652, Pariſ. 1653, Genevæ 1654, Lugd. Bat. & Ultra Traject. 1654. It is alſo in the *Meſſis Aurea* of SIBOLDUS HEMPSTERHUIS, printed Heidelberg. 1659, and with his own *Opuſcula*, Hafniæ 1670. *Vaſa Lymphatica, nuper Hafniæ in Animantibus inventa, & in Homine*, Hafniæ 1653, Pariſ. 1654. They are alſo extant with SIBOLDUS HEMPSTERHUIS *Meſſis Aurea*, Heidel. 1659; and alſo with his own *Opuſcula*, printed Hafniæ & Amſtelod. 1670. *Hiſtoria Nova Vaſorum Lymphaticorum*, publiſhed with LE CLERC, and MANGETUS's *Bibliotheca Anatomica*, printed Genev. 1685; *Dubia Anatomica*, Hafniæ 1653, Pariſ. 1653; *Defenſio Vaſorum Lacteorum*, &c. Hafniæ 1655; and with his *Opuſcula Anatomica*, 1670. *Hiſtoriarum Anatomicarum, Centuria prima & ſecunda*, Hafn. 1654; *Hiſtoriarum Anatomicarum, Centuria tertia & quarta*, ibid. 1657; *Hiſtoriar. Anatomicar. Centuria quinta & ſexta*, Hafn. 1661; *Vindiciæ Anatomicæ*, Hafn. 1648; *Opuſcula Nova Anatomica*, Hafn. & Amſtelod. 1670; *Obſervationes Anatomicæ Petri Pawi*, printed in the third and fourth Centuries of his own Obſervations, Hafn. 1657; *Collegium Anatomicum*, Hafniæ 1651; *Specilegium primum, ex Vaſis Lymphaticis*, Amſtelod. 1661, Hafniæ 1655, 1658, Roſtochii 1660; alſo with his *Opuſcula*, printed Hafniæ 1670; *Specilegium ſecundum, ex Vaſis Lymphaticis*, Amſtelod. 1660; *Specilegia bina ex Vaſis Lymphaticii*, Amſtelod. 1661, and with his own *Opuſcula nova Anatomica*, Hafniæ 1670; *Diſſertatio Anatomica de Hepate defuncto*, Hafn. 1661, and with his *Opuſcula Anatomica Nova*, Hafniæ 1670; *Reſponſio de Experimentis Anatomicis, Bilſianis*, &c. Hafniæ 1661, Amſtelodami 1661; *De Hepatis, Exautorati Cauſa Deſperata*, Hafniæ 1666; *De Cerebri Subſtantia pingui*, &c. Hafniæ 1669; *De Anatome Practica, ex Cadaveribus, morboſis adornanda Conſilium*, &c. Hafniæ 1674; *De Pulmonum Subſtantia & Motu Diatribe*, Hafniæ 1663, Lugd. Bat. 1672.

* His anatomical Works are, *De Ovariis Mulierum*, &c. Romæ 1677. Amſtelod. 1678, Norimb. 1679; *Epiſtola de Nervoſum, Uſu in Muſculorum Motu*, Pariſ. 1676; *Diaphragmatis Structura nova*, Pariſ. 1676; *Adminiſtrationum, Anatomicarum, Specimen*, publiſhed with *Michaelis Lyſen, Cultrum Anatomicum*, Francof. 1679; *Exercitationes Miſcellaniæ*, 1675. There are likewiſe ſeveral of his anatomical Pieces printed in the Acta Hafnienſia.

From

From the Time of the great HARVEY, there have been ſuch a Multitude of anatomical Writers, that a particular Detail of them would, of itſelf, require a Volume: I ſhall therefore only give a Catalogue of the principal, and take ſome Notice of their Diſcoveries, when of any Importance. I muſt, however, remark, that it would have been fortunate for Anatomy, and Students in this Science, if Authors could have contented themſelves with publiſhing their own Diſcoveries, and animadverting upon the Errors of others: But, inſtead of doing this, many have thought that a Diſcovery, ſometimes trifling enough, or a Profeſſor's Chair, have entitled them to write an entire Syſtem; thus making it neceſſary to ſearch large Volumes for Diſcoveries that a few Pages were ſufficient to contain.

GOTTOFREDUS BIDLOO was Profeſſor of Anatomy and Surgery at Leyden, and publiſhed 105 magnificent Figures, of different Parts of the Body, Amſt. 1685, in a very large Folio; ſome of which are ſaid not to be according to Nature.

THEOPHILUS BONETUS collected, with immenſe Labour, and publiſhed, a vaſt Number of Diſſections, that had been made upon Bodies which died of Diſtempers, or Caſualties; thereby excellently explaining the immediate Cauſes of Diſeaſes and Death.

This Work is, perhaps, the moſt valuable Piece that the Moderns have produced, and the beſt adapted to render a Phyſician perfectly acquainted with the Indiſpoſitions of the human Body*.

RICHARD

* His large Work, intituled, *Sepulchretum ſive Anatomia Practica*, was firſt publiſhed in two Volumes, Genevæ 1679, Folio.

MANGETUS publiſhed another Edition, with conſiderable Additions, in three Volumes, Lugd. 1700.

Richard Lower wrote an excellent Treatiſe on the Heart; wherein he advances ſeveral Things that are new, with reſpect to the ſpiral Order of the Fibres that compoſe this Part. There are ſeveral Editions of this Work. Thoſe I have ſeen are, Amſtelod. 1669, Lond. 1670. Magnet and Le Clerc have alſo printed it in their *Bibliotheca Anatomica.*

Marcellus Malpighius flouriſhed in the laſt Century, and was deſervedly celebrated for his great Skill and ſingular Sagacity in anatomical Reſearches.

His Induſtry was not confined to the more perfect Animals, but was extended to Inſects, and even Vegetables, to the great Improvement of natural Knowledge, and his own Honour. He was Member of the Royal Society of London.

Amongſt other Diſcoveries, he found, by his Microſcopes, that the cortical Part of the Brain conſiſts of an innumerable Company of very ſmall Glandules, which are all ſupplied with Blood by the capillary Arteries; and that the animal Spirit, which is ſeparated from the Maſs of Blood in theſe Glandules, is carried from them into the Medulla Oblongata, thro' little Pipes, one of which belongs to every Gland, whoſe other End is inſerted into the Medulla Oblongata: And that theſe numberleſs Pipes, which, in the Brain of ſome Fiſhes, look like the Teeth of a ſmall Ivory Comb, are properly that which all Anatomiſts, after Piccolhominus, have called Carpus Calloſum, or the medullary Part of the Brain.

There is alſo another Piece on the ſame Subject, intituled, *Prodromus Anatomiæ Practicæ, ſive de Abditis Morborum, Cauſis, ex Cadaverum diſſectione revelatis, Libri primi Pars prima, de Doloribus Capitis, ex illius apertione Manifeſtis,* Genev. apud Franciscum Miege, 1675, Octavo.

Before

Before his Time, the Texture of the Tongue was but gueſſed at, which occaſioned great Diſputes concerning the Nature of its Subſtance; ſome thinking it to be glandulous, ſome muſcular, and others of a peculiar Nature, not to be matched in any other Part of the Body.

This, therefore, MALPIGHIUS examined with his Glaſſes, and diſcovered, that it was cloathed with a double Membrane; that, in the inner Membrane, there are abundance of ſmall Papillæ, which have Extremities of Nerves inſerted into them, by which the Tongue diſcerns Taſte; and that, under this Membrane, it is of a muſcular Nature, conſiſting of numberleſs Heaps of Fibres, which run, all manner of Ways, over one another, like a Mat.

The Lungs, as moſt of the other Viſcera, were believed to be of a parencnymous Subſtance, till MALPIGHIUS found, by his Glaſſes, that they conſiſt of innumerable ſmall Bladders, that open into each other, as far as the outermoſt, which are covered by the outer Membrane that incloſes the whole Body of the Lungs; and that the ſmall Branches of the Trachea Aſpera are all inſerted into theſe Bladders, about every one of which the Veins and Arteries are entwined, in an almoſt inconceivable Number of Nets and Mazes, that the inſpired Air may preſs upon, or mix with, the Maſs of Blood, in ſuch ſmall Parcels as the Antients had no Notion of.

Till MALPIGHIUS diſcovered the Texture of the Liver by his Glaſſes, its Nature was very obſcure: But he has found out, that the Subſtance of the Liver is formed of innumerable Lobules, which are very often of a cubical Figure, and conſiſt of ſeveral little Glands, like the Stones of Raiſins, ſo that they look like Bunches of Grapes, and are each of them cloathed with a diſtinct Membrane;

 that

that the whole Bulk of the Liver conſiſts of theſe Grape-ſtone-like Glands. From whence it is plain, that the Liver is a glandulous Body, with its proper excretory Veſſels, which convey away the Gall that lay before in the Maſs of Blood.

He alſo diſcovered, that the Subſtance of the Spleen, deducting the numerous Blood-Veſſels and Nerves, as alſo the Fibres that ariſe from its ſecond Membrane, and which ſupport the other Parts, is compoſed of innumerable little Cells, like Honey-combs, in which there are vaſt Numbers of ſmall Glandules that reſemble Bunches of Grapes, and which there hang upon the Fibres, and are fed by Twigs of Arteries and Nerves, and ſend forth the Blood, there purged, into the Ramus Splenicus, which carries it into the Liver; to what Purpoſe, is not yet certainly diſcovered.

The Mechaniſm of the Reins was wholly unknown till MALPIGHIUS found it out. He, by his Glaſſes, diſcovered, that the Kidneys are not one uniform Subſtance, but conſiſt of ſeveral ſmall Globules, which are all, like ſo many ſeveral Kidneys, bound about with one common Membrane; and that every Globule has ſmall Twigs from the emulgent Arteries that carry Blood to it; Glands, in which the Urine is ſtrained from it; Veins, by which the purified Blood is carried off to the emulgent Veins, thence to go into the Cava; a Pipe to convey the Urine into the great Baſon in the Middle of the Kidney; and a Nipple, towards which ſeveral of thoſe ſmall Pipes tend, and thro' which the Urine ouzes out of them into the Baſon.

This clear Account of the Structure of the Reins, has effectually confuted ſeveral Notions, that Men had entertained, of ſome ſecondary Uſes of thoſe Parts; ſince hereby it appears, that every Part of the Kidneys is immediately and wholly ſubſervient

ſervient to that ſingle Work of freeing the Blood from its ſuperfluous Serum and Salt.

He alſo made ſome Obſervations concerning the lymphatic Veſſels and Glands, which are new *.

DOMINICUS DE MARCHETTIS ſucceeded VESLINGIUS, as Profeſſor of Anatomy, at Padua.

At the ſame Place lived PETRUS DE MARCHETTIS, who applied himſelf to Surgery.

The Works of both are in good Eſteem †.

HENRICUS MEIBOMIUS diſcovered ſome Veſſels of the Eye-lids which had not been taken Notice of before, which he gives an Account of in an Epiſtle that he wrote ‖.

WALTER NEEDHAM, an Engliſh Phyſician of the laſt Century, gave a good Account of the Membranes which involve the Fœtus, in his Book ‡.

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* His Works are, *Obſervationes Anatomicæ, de Pulmonibus*, printed with *Bartholini de Pulmonum Subſtantia, & Motu Diatribe*, Hafniæ 1663, Lugd. Bat. 1672; *Diſſertatio Epiſtolica de Bombyce*, Lond. 1669; *De Viſcerum, Nominatim Pulmonum, Hepatis*, &c. *Structura*, Amſtelod. 1669, Jenæ 1677; they are alſo in LE CLERC and MANGETUS's *Biblioth. Anatomica*, printed Genev. 1685; *Epiſtola Anatomicæ*, ibid. 1669; and in LE CLERC and MANGETUS's *Biblioth. Anatomica*, printed Genev. 1685; *Anatomes Plantarum*, Lond. 1675; *Anatomes Plantarum pars altera*, ibid. 1679; *Diſſertatio Epiſtolica de formatione Pulli in Ovo*, Lond. 1666; it is alſo in the *Biblioth. Anatomica* of LE CLEEC and MANGETUS, printed Genev. 1685; in which are likewiſe contained his Diſſertations; *De Cornuum Vegetatione*; *De Utero, & Viviparorum Ovis, & de Pulmonibus Epiſtolæ*; *Diſſertatio de Polypo Cordis*; *Epiſtolæ quædam circa illam de Ovo Diſſertationem*, &c. *Appendix Repetitas auctaſque de Ovo incubato Obſervationes continens*.

† That of DOMINICUS DE MARCHETTIS is, *Anatomia, cui Reſponſiones ad Riolanum Anatomicum, Pariſienſem in ipſius Animadverſionibus contra Veſlingium additæ ſunt*, Patav. 1652, ibid. 1654, Hardervici 1656; together with *Petri de Marchettis Nova Obſervatio, & Curatio Chirurgica*.

‖ *De Vaſis Palpebrarum, Novis Epiſtola, Vir Cl. Tr. Iſclam Langelot*, Helmſt. 1666; *De Medicorum Hiſtoria Scribenda Epiſtola, ad V. Cl. Georg. Hieronym. Velſchium*, Helmſt. 1669.

‡ *De Formatu Fœtus*, Lond. 1667, Octavo; Amſtelod. 1668, Duodecimo.

Johannes Pequet, of Dieppe, an Author of the laſt Century, rendered his Name famous by his Diſcovery of the Receptacle of the Chyle; which, however, it is ſaid, Bartholomæus Eustachius was acquainted with before him. But the World is obliged to Pequet for ſhewing, beyond all Contradiction, that the lacteal Veſſels convey the Chyle to this Receptacle; and for proveing, that it is thence carried, by particular Veſſels, through the Thorax, almoſt as high as the left Shoulder, and there thrown into the left ſubclavian Vein, and ſo directly carried to the Heart*.

Johannes Conradus Peyer, a Native of Schaffhauſen in Switzerland, is famous for having firſt given an accurate Account of the inteſtinal Glands, which, in a State of Health, ſeparate a Fluid, for the Lubrication of the Inteſtines, and which in Diarrhœas, or upon taking a Purge, ſupply the extraordinary Diſcharge that happens upon theſe Occaſions†.

Henry Rieley was Fellow of the College of Phyſicians; and, at the latter End of the laſt Century, publiſhed a Treatiſe on the Brain; in which he makes ſome Obſervations that had eſcaped the Notice of Willis and Vieussens. His Book is intituled, "The Anatomy of the Brain; con-

* His Works are, *Experimenta, nova Anatomica*, Harderv. 1651, Parif. 1654. To this Edition there is added, *Diſſertatio de Thoracicis Lacteis*, &c. &c. Amſtelod. 1661. They are alſo extant with the *Meſſis Aurea Siboldi Hemſterchius*, Lugd. Bat. Heidelberg. 1659; alſo in the *Biblioth. Anatomica* of Le Clerc and Mangetus, Genev. 1685, and with moſt Editions of the *Anatomia Reformata Thomæ Bartholini*.

† His Works are, *Exercitatio Anatomico-Medica, de Glandulis Inteſtinorum*, Schaffhauſæ 1677, Amſtelod. 1682. This is in the *Biblioth. Anatom.* of Mangetus and Le Clerc. *Pæonis & Pythagoræ Exercitationes Anatomicæ*, Baſil 1682; *Methodus Hiſtoriarum Anatomico-Medicarum*, &c. 1679; *Parerga Anatomica & Medica*, Amſtel. 1682; *Experimenta Nova circa Pancreas*, extant with the *Biblioth. Anatom.* of Le Clerc and Mangetus.

"taining

" taining its Mechaniſm and Phyſiology: To- " gether with ſome new Diſcoveries and Cor- " rections of modern Authors, upon that Subject. " To which is annexed, a particular Account of " Animal Functions, and Muſcular Motion; il- " luſtrated with Cuts." London, printed in the Year 1695.

OLAUS RUDBECKIUS, of Upſal in Sweden, has a great Diſpute with THOMAS BARTHOLINE about the Diſcovery of the lymphatic Ducts, to which both laid Claim.

It is certain, that Dr. JOLLIFFE, in England, remarked theſe Veſſels much about the Time, or ſomewhat before, theſe Antagoniſts obſerved them; and I ſee no Reaſon why all three may not equally pretend to the Glory of the Diſcovery, ſince it is probable that neither of them took the Hint from each other.

FREDERIC RUYSCH was born at the Hague, on the 23d Day of March 1638. He was the Son of HENRY RUYSCH, Secretary to the States General, and to ANNE Van BERGHEM. The Family from which he was deſcended, was originally of Amſterdam, where, from the Year 1365, his Anceſtors had, without Interruption, bore the moſt honourable Offices of the State, till the Year 1576; when a War happening betwixt Spain and the States, occaſioned a Revolution in the Fortunes of the Family.

But RUYSCH is far leſs conſiderable on account of his Extraction, than his diſtinguiſhed Merit, as

* His Works are, *Exercitatio nova Anatomico*, &c. printed Aroſiæ 1653, Lugd. Bat. 1654; it is alſo printed with the *Meſſis Aurea* of SIBOLDUS HEMPSTERHUIS, Heidelberg. 1659; and with the *Biblioth. Anatom.* of LE CLERC and MANGETUS, Genev. 1684; *Inſidiæ Structæ Olai Rudbeckii Sueci*, &c. Lugd. Bat. 1654; *Pro Ductibus Hepaticis, contra Bartholinum*, Lugd. Bat. 1654; *Epiſtola ad Thomam Bartholinum, de Vaſis Seroſis*, Upſaliæ 1657.

a Mem-

a Member of Society, a Phyſician, and an Anatomiſt.

In the Year 1664 he took his Degree of Doctor of Phyſic in the Univerſity of Leyden, and had, very ſoon after, a very fine, but at the ſame Time deplorable Opportunity, put into his Hands, of convincing the World, with how great Juſtice that Dignity was conferred upon him: For the Plague began to rage all over Holland; and he had the Care of thoſe, who were infected at the Hague, committed to him.

This Office, whatever Share of Glory it might procure him, was, nevertheleſs, far from being deſirable in itſelf. But it is no uncommon Thing for Merit and Learning to ſubject their Poſſeſſors to Inconveniences, from which the Ignorant and Illiterate are entirely free.

But his principal Buſineſs, and the Employment that engroſſed moſt of his Time, conſiſted in carrying Anatomy to that noble Height of Perfection which it had never before arrived at. Anatomiſts had long contented themſelves with ſuch Inſtruments as were judged neceſſary for ſeparating thoſe ſolid Parts, the particular Structures or mutual Relations of which they wanted to diſcover.

Regnier de Graaf, an entire Friend and intimate Acquaintance of Ruysch, was the firſt who, in order to diſcover the Motion of the Blood in the Veſſels, and the ſeveral Courſes it took during Life, invented a new Species of Syringe, by means of which he filled the Veſſels with ſome high-coloured Subſtance, which ſufficiently diſcovered the Road taken by itſelf, and, conſequently, that taken by the Blood in a living Animal.

This Invention was, at firſt, approved of; but the Practice was, ſoon after, diſcountenanced, becauſe the Matter made its Eſcape gradually, and left the Preparation good for nothing.

John

John Swammerdam endeavoured to ſupply this Defect in De Graaf's Invention, and happily concluded, that there was a Neceſſity for uſing ſome warm Subſtance, which, becoming gradually cool, in Proportion as it flowed into the Veſſels, might at laſt, when arrived at their Extremities, loſe the Nature of a Fluid, and, by that means, become capable of being retained in the Veſſels. This, no doubt, required a very nice and diſcerning Judgment, both with regard to the particular Quality of the injected Matter, its due Degree of Heat, and the juſt Momentum, or Proportion of Force, with which it was to be impelled.

By this means, Swammerdam firſt rendered the capillary Arteries and Veins of the Face viſible; but he did not long perſiſt either in the Uſe or Improvement of his new Invention: For an Exceſs of Piety, ſoon after, ſpoiled his anatomical Turn, and made him look upon ſuch Practices as impious.

The devout Swammerdam was, no doubt, afraid of rivalling the Almighty in the Perfection of his Works: But his Fears, in this Particular, were ill founded. And as the moſt exalted Degrees of Devotion rarely extinguiſh all the Motions of Vanity in the Heart; ſo Swammerdam was tempted to communicate his Invention to his Friend Ruysch; who was not only fond of, but afterwards practiſed it, without any Fear of offending God.

Upon his firſt Trial, he found the Experiment to ſucceed; and, in all Probability, produced a more perfect Preparation than Swammerdam himſelf had done. The Veſſels were ſo curiouſly injected, that the remoteſt Parts of their Ramifications, which were as ſlender as the Threads of a Spider's Web, became viſible; and, which is ſtill more ſurpriſing, ſometimes were not ſo without

out the Affiftance of a Microfcope. What, then, muft the Nature of that Subftance be, which is, at once, fo fine as to enter the imperceptible Cavities of thefe Canals, and, at the fame Time, is poffeffed of fuch a Quality, as to indurate itfelf there?

Small Ramifications were difcovered, that were neither obfervable in the living, nor to be feen in diffecting the Bodies of thofe which were newly dead.

The entire Bodies of Children were injected: For the Operation was thought very difficult, if not entirely impoffible, in Adults. Neverthelefs, in the Year 1666, by Order of the States General, he undertook to inject the Body of the Englifh Admiral BERCLEY, who was killed, on the 11th of June, in the Engagement betwixt the Dutch and Englifh Fleets.

This Body, tho' very much fpoiled, before RUYSCH put his artful Hand to it, was yet fent over to England, as curioufly prepared as if it had been the frefh Body of an Infant; and the States General beftowed a Recompence, which was at once proportioned to their Grandeur, and the Artift's Merit.

Every Part of the injected Matter preferved its Confiftence, Softnefs, Flexibility, and even gradually acquired frefh Degrees of Beauty with Time.

Bodies, with all their Vifcera, were fo far from having a naufeous Smell, that they even acquired an agreeable one; and that, too, in Cafes where they fmelled very ftrong before the Operation.

Every Part was preferved from Corruption by RUYSCH's Secret: A long Life afforded him the Pleafure of feeing, that his Preparations had, till then, been Proof againft the Shocks of Time;

and

and even put it out of his Power to aſcertain the Length of their future Duration.

All his injected Bodies glow with the ſtriking Luſtre and Bloom of Youth; they appear like ſo many living Perſons faſt aſleep; and their pliant Limbs pronounce them ready to walk. In ſhort, the Mummies of Ruysch were ſo many Prolongations of Life; whereas thoſe of the antient Egyptians were only ſo many deplorable Continuations of Death.

When Ruysch began to produce ſuch ſurpriſing Preparations, abundance of incredulous People pronounced the Facts impoſſible; but he gently oppoſed their Obſtinacy, with theſe Words: "Come, and ſee."—His Muſæum was not only always open, but richly ſtored, if I may be allowed the Expreſſion, with living Monuments of his Art, who were ready to pronounce in his Favour, and give the Lie to his Oppoſers.

A certain Profeſſor of Phyſic very ſeriouſly adviſed him to renounce theſe Novelties, and tread in the ſafe and beaten Paths of his Predeceſſors: But as Ruysch deſpiſed the fooliſh Admonition, the Doctor redoubled his Letters, and at laſt told him, that his Conduct, in that Particular, was inconſiſtent with the Dignity of a Profeſſor; to all which Ruysch replied, in a noble and truly Laconic Strain, "Come, and ſee."

Ruysch conceals the Name of the Profeſſor, who was ſo friendly, or rather ſo fooliſh, as to give him this Advice; but he has acted otherwiſe with regard to Raw and Bidloo, who were both famous for their Skill in Anatomy, and had openly declared themſelves againſt him; eſpecially Bidloo, who confidently boaſted, that he knew the Secret of preparing and preſerving Bodies better than Ruysch himſelf.

Upon this, RUYSCH aſked him, Why, ſince it was ſo, he had not diſcovered ſuch and ſuch Parts? And why he had mangled his anatomical Tables with ſo many notorious Blunders?

Conſidering the Advantages of his Secret of Injections at that Time of Day, and the ſtrong Curioſity that naturally reigned in RUYSCH's Breaſt, we need not be ſurpriſed, if the diſcovered Things, that had eſcaped the Notice of all that went before him, ſuch as the bronchial Artery, which ſupplies the Lungs with Nouriſhment, before unknown to the moſt minute and accurate Anatomiſts; the Perioſteum of the Officula Auditus, which were formerly looked upon as bare; the Ligaments belonging to the Articulations of theſe Oſſicula. He likewiſe found, that the cortical Subſtance of the Brain was not glandular, as was commonly thought, but conſiſted of Veſſels infinitely ramified: and that ſeveral other Parts, which were falſly looked upon as glandular Bodies, were no more than ſo many Congeries of ſimple Veſſels, which only differed in their reſpective Lengths, Diameters, the Curves they deſcribed in their Courſes, and the Diſtance of their Extremities from the Heart; Circumſtances on which the various Secretions or Filtrations depend.

FREDERIC SCHREIBER, who writes his Life, when talking of the Extent and Importance of his Diſcoveries, ſeems animated with a kind of Enthuſiaſm, and expoſtulates the Matter in this warm Strain: "Who, before him, obſerved the Veſſels "running thro' the Tunica Aranea, Patella, and "Acetabulum Coxæ? Who diſcovered the Veſ"ſels diffuſed in that Membrane which ſurrounds "the Marrow of the Vertebræ? Or who found "out the Veſſels in the Meditullium of the Bones, "and in thoſe Tendons and Ligaments which are "deſtitute of Blood?"

RUYSCH

Ruysch, beſides his Practice of Phyſic, and Profeſſorſhip of Anatomy, was, by the Burgomaſters of Amſterdam, appointed Inſpector of all thoſe who were either killed or wounded in perſonal Quarrels. He was likewiſe, for the general Good of the State, created Maſter of the Midwives, who, generally ſpeaking, were very ignorant of their Buſineſs. They were too haſty, for Inſtance, in forcibly extracting the Placenta, when it came not away; and were often raſh enough to tear it, which frequently cauſed unavoidable Death. But Ruysch taught them, tho' with ſome Difficulty, to wait with Patience for its coming away, or, at leaſt, only gently to aſſiſt its Expulſion; becauſe an orbicular Muſcle, which he had diſcovered in the Bottom of the Uterus, naturally thruſts it outwards, and was even ſufficient to expel it entirely.

At laſt, Ruysch was created Profeſſor of Botany, in the Exerciſe of which Office he gave the ſame Scope to his natural Genius which he had formerly done in Anatomy. The extenſive Commerce of the Hollanders, ſupplied him with many exotic Plants, which he diſſected and preſerved with incomparable Art. He dextrouſly ſeparated their Veſſels from their Parenchyma, and, by that means, plainly ſhewed wherein their Life conſiſted. Thus Animals and Plants were equally embalmed, and equally ſure of Duration, by the ſkilful Touches of Ruysch's Hand.

His Muſæum, or Repoſitory of Curioſities, contained ſuch a rich and magnificent Variety, that one would have rather taken it for the Collection of a King, than the Property of a private Man. But, not ſatisfied with the Store and Variety it afforded, he would beautify the Scene, and add an additional Luſtre to the curious Proſpect. He mingled Groves of Plants, and Deſigns of Shell-

work, with Skeletons and diſmembered Limbs; and, that nothing might be wanting, he animated, if I may ſo ſpeak, the Whole with appoſite Inſcriptions, taken from the beſt Latin Poets.

This Muſæum was the Admiration of Foreigners. Generals of Armies, Embaſſadors, Electors, and even Princes and Kings, were fond of viſiting it.

When PETER I. of Muſcovy went into Holland in the Year 1695, he was ſo ſtruck with the View of RUYSCH's Collection, that he tenderly kiſſed a little Infant, that ſparkled with all the Graces of real Life, and ſeemed to ſmile upon him. On his ſecond coming over in 1714, he purchaſed the Collection, and ſent it to Peterſburgh; but the Induſtry and long Experience of RUYSCH ſoon furniſhed him with another.

In the Year 1727, he was choſen honorary Aſſociate of the Univerſity of Peterſburg; he was alſo a Member of the Leopoldine Academy in Germany, and of the Royal Society in London.

He died of a Fever, in the 92d Year of his Age, in 1731; and had this peculiar Advantage over moſt other learned Men, that he lived to ſee all that Oppoſition, which Malice and Envy made to his Merit, huſhed and laid to Sleep.

RUYSCH publiſhed a great many Pieces, at different Times, which were, at laſt, reduced to a very confuſed and unaccountable Order, and printed, as the Title Page of the firſt Volume imports, Amſtelod. apud JASSONIO WAESBERGIOS, 1737.

There is a Peculiarity, in one Work of his, that deſerves to be taken Notice of; which is, that ſome Paſſages of his *Adverſaria*, which he publiſhed in Latin and Dutch, are left untranſlated into Dutch. What influenced this Author, in this Caſe, every one muſt judge for himſelf, from the

the Nature of the Paſſages untranſlated. All his Works are comprized in two Volumes, Quarto; printed in Latin at Amſterdam.

CHRISTOPHER GUNTHER SCHELHAMMER, a Phyſician, who, in the latter Part of the laſt Century, was Profeſſor of Phyſic at Jena for four Years, and afterwards removed into Denmark, where he ſpent the Remainder of his Days*.

He makes various Obſervations relative to the Tongue, Larynx, ſalivary Glands, Diaphragm, Meſentery, Colon, Inteſtinum Cæcum, Receptaculum Chyli, Kidneys, Fingers, Nails, Lymph, and lymphatic Ducts; all which are worthy of Conſideration.

Some detached Pieces of this Author are inſerted in the German Ephemerides; as The Anatomy of a Mole, and a Treatiſe *De Calculo Cerebri*.

NICOLAUS STENO, a Dane, flouriſhed about the Middle of the laſt Century. He enriched Anatomy with many valuable Diſcoveries. Amongſt other Things, he obſerved the Ducts which convey Moiſture to the Eye, for the Convenience of its Motion in the Orbit; and in 1662 deſcribed a ſalivary Duct, not taken Notice of before, that comes from the Glands which lie near the Ears. He alſo obſerved, that the Fibres of the muſcular Membrane of the Pharynx are ſpiral in a double Order, one aſcending, and the other deſcending, which run contrary Courſes, and mutually interſect each other in every Winding. Beſides theſe, he made ſeveral Obſervations concerning the Lympha Ducts. He was Great Uncle to WINSLOW.

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* He wrote a Book intituled, *In Phyſiologiam Introductio*, printed Helmæſtad. 1681, Quarto; and another intituled, *De Auditu Liber Unus*, Lugd. Bat. 1684, Octavo. This laſt, and his *Epiſtolica Diſſertatio, de Lymphe Ortu, & Lymphaticorum Vaſorum Cauſis*, are inſerted in the *Bibliotheca Anatomica*. He alſo publiſhed an Edition of CONRINGIUS's Introduction to Phyſic, with Notes.

Johannes Swammerdam was a celebrated Anatomiſt of Amſterdam, in the latter Part of the laſt Century; having been a favourite Pupil of Van Horne, under whom he made a conſiderable Progreſs in the Art of diſſecting and preparing Bodies.

De Graaf was Pupil to Van Horne at the ſame Time with Swammerdam, and is charged, by the latter, with Plagiariſm, in ſtealing the Diſcoveries of their common Inſtructor, and claiming them as his own.

His Works are in very good Eſteem, and are in the *Bibliotheca Anatomica.*

William Briggs wrote an accurate Deſcription of the Eye, with the Method of diſſecting it, intituled, *Ophthalmographia*, Cambridge 1675, Octavo: This is alſo in Magnetus's *Bibliotheca Anatomica.* From the Structure of the Eye, he formed a Theory of Viſion, which is in the *Acta Eruditorum*, 1683.

He diſcovered, that, in the Tunica Retiformis, which is contiguous to the vitreous Humour, the Filaments of the Optic Nerve there expanded, lie, in a moſt exact and regular Order, all parallel to one another; which, when they are united afterwards in the Nerve, are not ſhuffled confuſedly together, but ſtill preſerve the ſame Order till they come to the Brain.

The cryſtalline Humour had before been diſcovered to be of the Figure of a double convex Lens, compoſed of two Segments of unequal Spheres, and not perfectly ſpherical, as the Antients thought: So that this farther Diſcovery, made by Briggs, evidently ſhews, why all the Parts of the Image are ſo diſtinctly carried to the Brain, ſince every Ray ſtrikes upon a ſeparate Filament of the Optic Nerve; and all thoſe Strings, ſo ſtruck, are moved equally at the ſame Time.

He alſo deſcribes the Ducts that convey Moiſture to the Eyes, from the Glands in the Corners thereof, for the Convenience of their Motion in their Orbits.

DUPRE is an Author mentioned by GOELICKE, who informs us, that he publiſhed a Deſcription of five Pairs of Muſcles, which are concerned in moving the Head in different Directions, and that are inſerted into the firſt and ſecond Vertebræ of the Neck.

He, according to the ſame Author, deſcribed two Ligaments, that connect the Head either to the firſt or ſecond Vertebra of the Neck.

FRANCIS GLISSON, an Engliſhman, was Profeſſor of Phyſic at Cambridge, and Fellow of the College of Phyſicians. His principal Diſcovery was the Duct that conveys the Bile from the Liver to the Gall Bladder.

REGNERUS DE GRAAF was a Phyſician of Delft in Holland. He publiſhed ſeveral anatomical Pieces, which are in the *Bibliotheca Anatomica.* Two Diſſertations of this Author, alſo, are extant in the German Ephemerides; one on the Indurations of the carotid Arteries, the other on a monſtrous Uterus.

Many new Things, concerning the reſpective Subjects he treats of, are contained in the Works of this Author; but he is charged with borrowing them from Van HORNE, whoſe Pupil he was. It is, however, remarkable, that his Invention of the Syringe gave Birth to all the Diſcoveries in Anatomy that have, ſince his Time, been made by means of Injections.

NATHANIEL HIGHMORE publiſhed an anatomical Work, under the Title of, *Corporis humani Diſquiſitio Anatomica*, &c. Hagæ Comitum 1657, Folio.

The large Cavity of the ſuperior Maxilla is called, from him, ANTRUM HIGHMORIANUM; but he is not the firſt Deſcriber of it; for CASSENIUS takes Notice of it, under the Name of ANTRUM GENÆ.

JOHANNES VAN HORNE was Profeſſor of Anatomy at Leyden. His anatomical Pieces bear a very good Character; and he has the Reputation of having diſcovered the thoracic Duct, and is ſaid to be the firſt who was acquainted with the true Structure of the Teſticles: He alſo gave the Name of Ovaria to what was before called the Teſtes of Females.

DE GRAAF is ſaid to be much obliged to him for the Diſcoveries he has publiſhed with reſpect to the Parts of Generation*.

ANTONIUS MARIA VALSALVIA, a Phyſician, born at Imola, a City of Italy, was Profeſſor of Anatomy at Bologna. His Treatiſe on the Ear is eſteemed as an excellent Performance, and contains many Diſcoveries relating to that Organ. He alſo deſcribes, and gives new Figures of, the Muſcles of the Uvula and Pharynx.

GUICHARD JOSEPH DU VERNEY, a celebrated Anatomiſt, was born at Feurs in Forez, Auguſt 5, 1648. His Father, JAQUES DU VERNEY, was a Phyſician at that Place. He ſtudied Phyſic five

* His Works are, *Novus Ductus Chyliferus, nunc primum, delineatus, deſcriptus, & eruditorum, examini expoſitus*, Lugd. Bat. apud FRANC. HACKIUM, 1652, Quarto; *Microcoſmos, ſeu brevis Manuductio ad Hiſtoriam Corporis humani, in Gratiam Diſcipulorum edita*, Lugd. Bat. apud JAC. CHOVET, 1660, Duodecimo; ibid. apud eundem, 1662, Duodecimo; ibid. apud eund. 1663, Duodecimo; Lipſiæ, apud JOHANNEM FRITSCHIUM, 1675, Duodecimo; *Leonhardi Botalli Opera omnia*, Lugd. Bat. apud DANIEL & ABRAH. A GAASBEAK, 1660, Octavo; *Prodromus Obſervationum ſuarum, circa Partes Genitales, in utroque ſexu*, Lugd. Bat. 1668, Duodecimo; *Obſervationes Adatomico-Medicæ*, Amſtelod. apud ABRAH. WOLFFGANG, 1674, Duodecimo.

Years

Years at Avignon, and came to Paris 1667, where he was, ſoon after, employed in diſſecting the Brain, before Aſſemblies of learned Men, who uſed to meet at the Abbé BOURDELET's, and at Mr. DENYS's, a learned Phyſician at Paris.

He acquitted himſelf ſo well on theſe Occaſions, that, in 1676, he was received into the Royal Academy of Sciences as a Member, and afterwards read Lectures in Anatomy to the Dauphin.

In 1679, he was conſtituted Profeſſor of Anatomy at the Royal Garden; and in 1683, he publiſhed his *Traitè de l'Organe de l'Oüe*, which the following Year was tranſlated into Latin, and printed at Neuremberg. This Treatiſe is in great Eſteem.

He died September 10, 1730.

JOHANNES GEORGIUS VIRSUGUS was a Bavarian, and conſiderable Anatomiſt. He publiſhed no Work, but rendered himſelf famous by the Diſcovery of the Duct of the Pancreas, which diſcharges the Fluid, ſeparated in that glandulous Subſtance, at the ſame Place where the Ductus Communis Cholodochus opens into the Duodenum. This he diſcovered in 1642.

He was, not long after, ſhot by an Italian, in his own Study; who, it was thought, had been hired to murder him.

His Name is ſometimes ſpelled WIRTUMGUS.

THOMAS WHARTON was an Engliſh Phyſician, and in 1656 publiſhed a Treatiſe on the Glands, intituled, *Adenographia*; in which there are many curious Particulars, not known before.

In particular, he diſcovered a Duct, which, ariſing from the conglomerate Glands that are ſituated in the inner Side of the inferior Maxilla, conveys Saliva, which it diſcharges, near the Middle of the Chin, into the Mouth.

Anthony Nuck, a Dutch Phyſician, firſt practiſed his Profeſſion at the Hague, and afterwards was Profeſſor of Anatomy at Leyden. He was a moſt experienced and indefatigable Anatomiſt; having diſſected with his own Hands, in the Space of eight Years, a great many human Subjects.

The Way how the aqueous Humour of the Eye, when by Accident loſt, may be, and is, conſtantly ſupplied, was firſt found out and deſcribed by Nuck; who diſcovered a particular Canal ariſing from the internal carotid Artery, which, creeping along the ſclerotic Tunic of the Eye, perforates the Cornea near the Pupil, and then, branching itſelf curiouſly about the Iris, enters into, and ſupplies, the aqueous Humour. He alſo diſcovered ſome ſalival Glands, not mentioned by Wharton, Steno, Bartholine, or Rivinus.

He ſays, that the Breaſts are Heaps of Glands, ſupplied with Blood by innumerable Ramifications of the axillary and thoracic Arteries; ſome of which, paſſing thro' the Breaſt Bone, unite with the Veſſels of the oppoſite Side. Theſe Arteries, which are inconceivably ſmall, part with the Milk in thoſe ſmall Glands into ſmall Pipes; four or five of which, uniting, make one ſmall Trunk. Of theſe ſmall Trunks, the large Pipes, which terminate in the Nipple, are compoſed; tho', before they arrive there, they ſtreighten into ſo ſmall a Compaſs, that a ſtiff Hair will juſt paſs through.

The Nipple, which is a fibrous Body, has ſeven, eight, or more Holes, thro' which every Tube emits its Milk, upon Suction; and, leſt (any one of them being ſtopped) the Milk ſhould ſtagnate, they all have croſs Paſſages into each other, at the Bottom of the Nipple, where it joins to the Breaſt.

He

He ſays, that the lympha Ducts ariſe immediately from the Arteries; and that many of them paſs thro' the conglobate Glands which are diſperſed in the Abdomen and Thorax, in their Way to the Receptacle of the Chyle, or thoſe Veins that receive them.

His Works, which I have ſeen, are, *Adenographia*, *Sialographia*, *&* *Operationes*, *&* *Experimenta Chirurgica*, in three ſmall Volumes, printed Lugd. 1722.

Anthony Van Leeuwenhoeck has obliged the World with a great many Diſcoveries relative to Anatomy; particularly, by means of his Microſcopes. It is not poſſible to give the Particulars of his Works, without tranſcribing them. Many detached Pieces of this Author were publiſhed at different Times; but his entire Works were printed Lugd. Bat. 1722.

He has made evident the Anaſtomoſes of the Arteries with the Veins, and diſcovered a prodigious Number of Animalcula in the Semen of male Animals.

Philip Verheyen was born in the Year 1648. He intended originally to turn his Studies towards Divinity; but, having loſt one of his Legs by a Mortification, he applied himſelf entirely to Phyſic, and was Profeſſor of Anatomy and Surgery at Louvain, where he acquired great Reputation, and died of a Fever 1711, much regretted by the learned World.

His Anatomy bears an excellent Character, and has gone thro' ſeveral Editions; the third of which is that printed Brux. 1726, 2 Vols. 4to.

Clopton Havers was an Engliſh Phyſician, wrote admirably well on the Bones, and made ſome conſiderable Diſcoveries with reſpect to the Perioſtæum and Marrow. He diſcovered in every

" cerned, and whoſe Structure ſhould be ſo much " conſidered, not only in this Operation, but in " the High Way for cutting for the Stone. He, " too, is the firſt who has plainly ſhewn, that the " Elongation of the external Lamella of the Pe- " ritonæum does not form the Tunica Vaginalis " of the Teſticles, as Authors ſay, but a Coat " peculiar to the ſeminal Veſſels, which he very " properly calls TUNICA VASORUM SPERMATI- " CORUM PROPRIA."

And he afterwards obſerved, in reading PAULUS, that this Tunic was known to, and deſcribed by, him, by the Name of ἑλικοειδὴς, from the many Contorſions there are in thoſe Veſſels, which it covers.

FRANCIS NICHOLLS, a Phyſician, did not publiſh any Thing in Anatomy, that we know of, except his *Compendium Anatomico-Oeconomium*, and ſome Eſſays in the Philoſophical Tranſactions. But his uncommon Application to this Science, and his ſingular Sagacity in anatomical Reſearches, make it hoped, that he will ſome Time oblige the World with an Account of his Diſcoveries.

The Editors of the Edinburgh Medical Eſſays ſome where obſerve, that ALBINUS had injected the Veſſels of the Tunic of the cryſtalline Humour of the Eye; and ſeem to think it a new Diſcovery. On this Occaſion I cannot forbear taking Notice, that NICHOLLS has injected theſe Veſſels above twenty Years ago.

JOHANNES BAPTISTA MORGAGNUS was born at Forli, in the Eccleſiaſtical State, and Profeſſor of Anatomy at Bologna. He made conſiderable Diſcoveries in Anatomy, relating to the Muſcles of the Os Hyoïdes, Uvula, Pharynx, Tongue, Epiglottis, arytenoïd and ſebaceous Glands, Bladder, Uterus, Vagina, and Breaſts.

His

His Works are, *Adverſaria Anatomica*, which were collected and printed at Leyden 1723, 4to; *Epiſtolæ Anatomicæ duæ*, Lugd. Bat. 1728, 4to.

Profeſſor ALBINUS has publiſhed ſome anatomical Pieces, which are in much Eſteem; and the World is in Expectation of more from the ſame Hand. His Works which have come to my Knowledge are, *Diſſertationes de Fonculis*, Franc. 1681, Quarto; *Diſſert. de Cantharidibus*, ibid. 1687, Quarto; *Diſſert. de Paronychia*, ibid. 1694, Quarto; *Diſſert. de Cataracta*, cum Fig. ibid. 1695, Quarto; *Diſſert. de Ægilope*, ibid. Quarto; *Diſſert. de Partu difficilii*, ibid. 1696, Quarto; *Index Supellectilis Anatomicæ Rauianæ, cum Raui Vita & Calculoſorum curatione*, cum Fig. Lugd. Batav. 1727; *Academicarum Annotationum Anatom. Patholog. Phyſiolog. & Zoograph.* in Three Parts, Lugd. 1756.

LAURENTIUS HEISTER, a celebrated Profeſſor at Helmſtead, publiſhed a Book intituled, *Compendium Anatomicum, Veterum, Recentiorumque, Obſervationes, breviſſime Complecterus*, Altorfii 1717, 4to; Altorf. & Norimb. 1732, & 1741.

This Compendium is of very little Service for Beginners; as being full of critical Obſervations which were doubtful in thoſe Days, and have ſince been cleared up by Anatomiſts.

The Deſcription of the Parts of the human Body are hardly pointed out; and it is amazing to me, that the Public does not pay more Regard to VERDIER's Abſtract of the Anatomy of the human Body, which is built on WINSLOW's Syſtem, and now tranſlated into Engliſh.

He has ſince publiſhed his Practical Obſervations, in one Volume, in German; which is tranſlated into Engliſh, but not much eſteemed.

Likewiſe, *Compendium Medicinæ Practicæ cui præmiſſa eſt de Medicina Mechanica præſtantia Diſſertatio*, Amſtelod. 1743.

Alſo,

Alſo, *Inſtitutiones Chirurgicæ, in quibus quicquid ad rem Chirurgicam pertinet, optima & noviſſima ratione per tractatur, atque in Tabulis multis æneis præſtantiſſima ac maxime neceſſaria Inſtrumenta itemque artificia, ſive encheiriſes præcipuæ & vincturæ Chirurgicæ repreſentantur. Opus quadraginta fere annorum nunc demum, poſt aliquot Editiones Germanica Lingua evulgatas, in exterorum gratiam Latine altera vice publicatum.* Amſtelod. apud JANSSONIO-WAESBERGIOS, 1747 *.

ALEXANDER MONRO was a celebrated Profeſſor of Anatomy at Edinburgh, and Author of a Treatiſe of OSTEOLOGY and NEUROLOGY, which are in great Eſteem.

I do not know that he has publiſhed any Thing elſe, except ſome Pieces in the Medical Eſſays.

The laſt Edition of his OSTEOLOGY was printed Edinburgh, 1750.

JAMES BENIGNUS WINSLOW, Profeſſor of Phyſic, Anatomy, and Surgery, in the Univerſity of Paris, Member of the Royal Academy of Sciences, and of the Royal Society at Berlin; in the Year 1723 publiſhed an excellent Work intituled, *Expoſition Anatomique de la Structure du Corps humain*, Quarto.

It is eſteemed as the beſt Syſtem of the ſolid Parts of the Body that has yet appeared; and is remarkable for Conciſeneſs, Perſpicuity, and the exact Order of the Work.

Beſides his Anatomy, there are ſeveral Diſcoveries and Improvements that he has made in the Animal Oeconomy, which are inſerted in the Memoirs of the Royal Academy of Sciences at Paris

* In this Syſtem there are many Things out of Practice: And as for the Repreſentation of the Chirurgical Inſtruments, they are very bad.

ALBERT

Albert de Haller, Preſident of the Royal Society of Sciences at Gottingen, Member of the Royal Academy of Sciences at Paris, London, Berlin, Stockholm, &c. This ingenious and laborious Profeſſor has favoured the World with the following Works, which came to my Knowledge.

Experimenta & Dubia de Ductu Salivali Coſchwiſiano, Leid. 1727, 4to; and in Diſp. Anat. Select. Vol. I.

Verſuche, Scheveizeriſcher Gedichte. The beſt Editions were printed at Bern 1732, 1734, 1743, in 8vo; Gottingen 1748, 1749, 8vo; the ſame 1751, 1752, 8vo; and alſo with a Variety of Lectures of the ſpurious Editions of Gedan 1743, 8vo; Tiguri 1750, 8vo; in German, in French, and in both Languages together. The French Tranſlation was publiſhed at Gottingen and Zurich 1730, 8vo; and at Lyons 1752, 12mo; but theſe are not genuine Editions.

Diff. de Muſculis Diaphragmatis, Bern. 1733, 4to; Lipſiæ and Leidæ 1738, both 4to; and in his anatomical Works printed at Gottingen 1751, 8vo.

Quod Veteres eruditione antecellant modernos, Bernæ 1734, 4to Oratio.

De Fœtu bicepiti ad pectora connato, Figuri in tempe Helvet. 1735, 8vo; Hanov. 1738, 4to, with Additions and Copper Plates; the ſame was alſo publiſhed, in a more correct and extenſive Manner, Gotting. 1751, 8vo; and amongſt the anatomical Works.

De Methodo ſtudii Botanici, Gotting. 1736, 4to; and, more correct, in the Botanical Works printed Gotting. 1749, 8vo.

Quod Hippocrates Corpora Humana ſecuerit, Programma, Gotting. 1734, 4to; and in the anatomical Works.

De

De Vaſis Cordis, Diſp. Gotting. 1737, 4to; and in Collect. Diſp. Select. 2 Vols.

De Motu Sanguinis per Cor, Gotting. 1737, 4to; and in Collect. Diſp. Select. 2 Vols.

De Veronicis quibuſdam Alpinis, Gottingen 1737, 4to; Programmata duo.

De Pedicularibus Helveticis Specimen, Gotting. 1737, Diſputatio.

De Valvula Euſtachii, Progr. Gotting. 1738, 4to; Lipſiæ 1739, 4to; and in 2 Tom. Diſp. Select.

De Vulnere Sinus Frontalis, Programma, Gotting. 1738, 4to.

Obſervationes Botanicæ ex itinere Hercinico, Gotting. 1748, 4to; and, more correct, in the Botanical Works.

De Allantoïde humana, Progr. Gotting. 1729, 4to.

Ex Femina gravida Obſervationes, Diſp. Gotting. 1739, 4to; and in Diſp. Select. Vol. V.

De Vaſis Cordis Obſervationes itineratæ, Gotting. 1739, 4to; Progr. recuſ. in 2 Tom. Diſp. Select.

Hermanni Boerhaave Prælectiones Academicæ in ſuas Inſtitutiones rei Medicæ, with his Notes, 1 Tom. Gotting. 1739, 8vo. The Additions to this Volume were printed at the ſame Place 1740, 8vo; and a new Edition of the ſame Volume ibid. 1740.

Iter Helveticum Anni 1739, Gotting. 1740, 4to; and, more correct, in the Botanical Works.

Strena Anatomica, Progr. Gotting. 1740, 4to; and in his Anatomical Works.

De Ductu Thoracico, Diſp. Gotting. 1741, 4to; and in Tom. I. Diſp. Anat. Select.

De Diaphragmate, Progr. Gotting. 1741, 4to.

Ob-

Obſervationes Myologicæ, Gotting. 1742, 4to, Progr.

Duorum Monſtrorum Anatome, Gotting. 1742, 4to; and in the Anatomical Works.

De Fœte Capite Semibifido, Progr. Gotting. 1742, 4to; and in his Anatomical Works.

De Valvula Coli, Progr. Gotting. 1742, 4to; and in Vol. I. of Select Diſputes of Anatomy.

De Omento Progr. 1 & 2, Gottingen 1742, and in the firſt Collection of the Anatomical Prints.

Enumeratio Methodica Stirpium Helveticarum, Gotting. 1742, Folio.

De Vera Nervi Intercoſtalis origine, Diſp. Gotting. 1743, 4to; and in Tom. II. Diſp. Select. Anatom.

De Arteriis Bronchialibus & Oeſophagicis, Gotting. 1743, 4to, Diſp. and in Tom. III. Diſp. Select. Anatom.

Iconum Anatomicarum partium Corporis humani, Faſciculus I. Gotting. 1743, 1747, Folio. The Printer hath added to theſe, two Plates of the celebrated Huber.

Faſciculus VIII. Gotting. 1755, Folio. This laſt completes the whole Work.

Enumeratio Plantarum Horti & Ægri Gottingenſis, Gotting. 1743, 8vo; and, with greater Additions, 1753, 8vo.

De Nervorum in Arterias imperio, Diſp. Gotting. 1744, 8vo; and in Vol. Diſp. IV.

Flora Jenenſis C. H. Ruppii ex Schedis M. S. auctoris & meis Obſervationibus emendata & aucta, Jen. 1744, 8vo.

Herm. Boerhaave Conſultationes Medico variis acceſſionibus auctæ, Gotting. 1744, 8vo; Pariſ. 1748. They were publiſhed in Latin and French 1749, 8vo; and Haller cauſed them to be printed

printed, with greater Additions and Corrections, at Gotting. 1752, 8vo.

De fetu Cerebro deſtituto, Progr. Gotting. 1745, 4to, in Opuſcul. Anatom. recuſum.

De Generatione Monſtrorum mechanica, Progr. Gotting. 1745, 4to, recuſum in Opuſcul. Anat.

De Viis ſeminis Obſervationes, Progr. 1745, 4to, recuſum in Diſp. Anat. Vol. V.

De alii genere naturali, Gotting. 1745, 4to; recuſus libellum in Opuſc. Botan. 1749.

H. Boerhaave de Morbis Oculorum prælectiones, Gotting. 1746, 8vo; much more correct, by the illuſtrious Willichius, 1750, 8vo. They have been reprinted at Venice 1748, 8vo; and at Paris 1748, 8vo; afterwards in French 1749, 12mo. J. F. Clauder tranſlated them into German from the firſt Edition, and publiſhed them at Nuremberg in 1751, 8vo.

De Reſpiratione Experimenta Anatomica, Gotting. 1746, 4to, recuſa inter Opuſc. Anatom. Patholog.

Eorum Pars prodiit, Gotting. 1747, 4to, & pariter inter Opuſcula utraque recuſa eſt.

Diſputationum Anatomicarum Selectiorum, Vol. I. Gotting. 1746, 1750, 4to; Vol. VII. Gotting. 1751, 4to. The Index was compoſed by the illuſtrious Willichius at Gottingen 1752, 4to.

Primæ Lineæ Phyſiologicæ, Gottin. 1747, 8vo. The French Tranſlation appeared at Paris 1752, 8vo; and again at Gottingen, with the Additions of Peter Turin. Samuel Mihles tranſlated them into Engliſh, which were publiſhed in London 1758, 8vo; 2 Vols.

Deux Memoirs ſur le Mouvement du Sang, & ſur les Effets de la Saignée fondés ſur des Experiences, faites ſur des Animaux, â Lauſanne 1756.

De

De Foramine Ovali & Valvula Euſtachii, Progr. Gotting. 1748, Fol. and in Faſciculo IV. Iconum.

Opuſcula Botanica recenſa & aucta, Gotting. 1749, 8vo.

De Rupto Utero, Progr. I. & II. Gotting. 1749, 4to; and amongſt his Pathological Works.

De Gibbo, Progr. 1749, 4to; & in iiſdem Opuſculis.

De Morbis Ventriculi, Progr. 1749, 4to; & in iiſdem Opuſculi.

De Oſſificatione præternaturali, Progr. 1749, 4to; & in iiſdem Opuſculis. Suecice in Act. Stockholm. 1749, 8vo; Gallice in Nouveau Magaſin de Londres, 1750, 8vo.

De Aortæ & Venæ Cavæ gravioribus morbis, Progr. 1749, 4to; & in Opuſcul. Patholog.

De Calculis Veſicæ Felleæ, Progr. 1749, 4to; & his Opuſculis.

De Morbis Pulmonis, Progr. 1749, 4to; & in his Opuſculis.

De Morbis quibuſdam Uteri, Progr. 1749, 4to.

De Herniis congenitis, ibid.

H. Boerhaave de Methodo Studii Medici, with the ample Commentaries of Haller, Amſtelod. 1751, 4to; Venet. 1753, 4to.

Prüfung der Secte die an allem zweifeldt, which was tranſlated from the French of Peter Crousaz and Samuel Formey, by Haller; who added a Preface to it, and publiſhed it at Gottingen in 1751, 8vo. The ſame was alſo publiſhed in French at Neufchatel 1755, 12mo, by Monſieur Seigneux.

Opuſcula Anatomica recenſa & aucta, Gotting. 1751, 8vo.

Reflexions ſur le Siſteme de la Generation de Mr. Buffons, Paris 1751, 12mo; erat Præfatio

ad Editionem Germanicam, Tomi III. Hiſtoriæ Naturalis, extat enim in bibl. impart. T. V. p. 3.

Lettre à Monſieur de Maupertius, avec ſa Reponſe, Gotting. 1751, 8vo; Paſſim recuſa, Germanice & Gallice, Francf. & Lipſ. 1751, & Hagæ com. 1752, 8vo.

De Morbis Colli, Progr. Gotting. 1753, 4to; hoc idem & ſequentia ad N° 88, in his Opuſculis recuſa ſunt.

De Calculis Felleis, Gotting. 1753, 4to.

De Induratis Partibus Corporis humani, Gotting. 1753, 4to.

De Monſtroſis Fabricis, Gotting. 1753, 4to.

Herniarum Hiſtoriæ, Gotting. 1753, 4to.

De Morbis Uteri, ibid.

De Renibus coalitis & monſtroſis, Gotting. 1750, 4to.

Diſſertation ſur les Parties ſenſibles & irritables des Animaux, Lauſann. 1755, 12mo. The ſame is alſo inſerted, in Swede, in the Tranſactions of the Academy of Stockholm of the Year 1753.

The ſenſible Parts are,

The Brain, Nerves, viz. their Medulla, and the following Parts, by means of the Nerves.

The Skin, Muſcles, internal Membrane of the Stomach, Inteſtines, and Bladder; the Ureters, Breaſt, Uterus, Vagina, Penis, Tongue, Teeth, Eyes, and eſpecially the Retina; the Tunica Choroïdes, but leſs than the Retina; the Heart, tho' not ſo much as the other Muſcles.

The Viſcera, Lungs, Liver, Spleen, Kidneys, and Glands, have few Nerves beſtowed upon them; and, conſequently, are not endowed with much Senſation.

The inſenſible Parts are,

The Cuticle, cellular Membrane, Fat, Tendons, Membranes which cover the Viſcera and Ar-

Articulations, Mediaſtinum, Omentum, Meſentery, Dura and Pia Mater, Ligaments, Perioſteum, Pericranium, Bones, Marrow, Cornea, and Iris.

The Arteries and Veins are inſenſible, except thoſe which are accompanied with Nerves; ſuch as the carotid, lingual, temporal, pharyngal, labial, thyroïdal, and the Aorta near the Heart.

The Cornea, HAVER's Gland, and Tunics of the Nerves, are likewiſe inſenſible.

The irritable Parts are,

The Heart, Muſcles, Diaphragm, Oeſophagus, Stomach, Inteſtines, lacteal Veſſels, thoracic Duct, Bladder, Glands and mucous Sinuſes in Man, Uterus and Genitals; which laſt are endowed with an Irritability peculiar to themſelves.

The unirritable Parts are,

The Nerves, Cuticle, Skin, Membranes, Arteries, Veins, cellular Membrane, Urethra, Ureters, Lungs, Liver, Spleen, Dartos and round Ligaments of the Uterus, Tendons, Ligaments, Perioſteum, Meninges of the Brain, and the Iris.

The excretory Ducts can ſcarcely be called irritable, at leaſt they require a very ſtrong Irritation.

The Parts which are both ſenſible and irritable, are,

All thoſe which have Nerves and muſcular Fibres, the Muſcles, Heart, the whole alimentary Canal, Diaphragm, Bladder, Uterus, Vagina, and Genitals.

Inſects are irritable and ſenſible all over.

Diſputationum Chirurgicarum Selectarum, Tom. I. & II. Lauſan. 1755, 4to. Three more Volumes will be publiſhed.

Opuſcula Pathologica, accedit Pars IV. Experim. de Reſpiratione, Lauſan. 1755, 8vo.

In other Journals have been publiſhed the following Works:

In the Commentaries of the Royal Society of Sciences of Gottingen,

Vol. I. of the Year 1752, Oratio de Utilitate Societatum ad Scientiarum augmentum conditarum.

De Hermaphroditis.

De cordis Motu a Stimulo nato, Diff. publiſhed in German in the Algem Magaſin, Tom. III. and in French, Lauſan. 1755, 12mo.

Obſervationes Botanicæ.

In Tom. II. Gottingen 1752 edito, de Partibus Corporis humani ſenſibilibus & irritabilibus, Pars I. & II. eſt Libellus idem N° 89.

Obſervationes Botanicæ.

In Tom. IV. Gotting. 1755, Experiments on the Motion of the Blood.

In the Philoſophical Tranſactions,

N° 472. Steatoma Ovarii, in Opuſculis Pathologicis recuſum.

Cyani nova Species.

N° 474. Scirrhus Cerebelli, in Opuſculis recuſum.

N° 483, & 492. Hiſtoria Venæ Cavæ coalitæ & ultimi ſenii, etiam in Opuſculis recuſa.

N° 494. Viæ Seminis cum Icon. & Experimenta de Reſpiratione.

In the Tranſactions of Upſal,

Anno 1742, Membranæ Papillaris deſcriptio. It is alſo inſerted in the Academical Tranſactions of Sciences of Swedeland, and in Opuſculis Anatomicis.

Amethyſtina novum Plantæ Genus.

In

In the Literary Commerce of Raræ aut Novæ Plantæ Alpinæ, Annis 1732, 1733, 1734, 1735, 1736;

Phthiſici Diſſectio, 1734, p. 187. & in Opuſculis Pathologicis.

Peripneumonia Hiſtoria, 1735, p. 12. & in iiſdem Opuſculis.

Obſervationes Anatomicæ, 1735, p. 107, & 188.

Variolarum Anni 1735, Hiſtoria, 1736, p. 73. & in Opuſculis Pathologicis.

Exemphalos congenitus, 1736, p. 78. & in iiſdem Opuſculis.

Obſervationes Botanicæ, 1744, p. 7.

Prefaces,

Ad Weinmanni Magnum Opus Botanicum Præfatus, de nonnullis Iconographis inter Germanos egi.

Ad novam Editionem Hiſtoriæ morborum Urates lavienſium, Lauſan. 1746, 4to.

Ad Opus Petri Crouſazii Baylio oppoſitum, in Compendium redact. a clar. Viro Samuele Formey. Vide N° 78.

Ad Collectionem Itinerum quæ meis conſiliis Gotting. prodit, Gotting. 1750, 8vo.

Ad Werthofii viri ſummi Poemata, Hanover 1749, 8vo.

Ad Verſionem Germanicam Operi Buffoniani, ad Tomum I. Lipſ. 1750, 4to.

De Utilitate Hypotheſum ad Tomum III.

Objectiones contra clariſſimi viri Syſtema de Generatione. Hæc ſeorſum extat, uti dixi N° 80, pauculas etiam Tomo IV. notutas adſperſi.

We omit the other ſhort Prefaces.

Journals,

HALLER hath wrote a Preface in the Literary Tranſaction of Gottingen from 1747 to 1753 (which Year he went to his own Country): However, he aſſiſted in the Compoſition of thoſe Works from the Year 1745 to 1755.

He has alſo anſwered to ſeveral Criticiſms in the Bibliotheque Raiſonné, Germanique, &c*.

I muſt not omit mentioning the ingenious Dr. PARSONS, Fellow of the Royal Society, for his endeavouring to explain, in his Crounian Lectures on muſcular Motion, the human Phyſiognomy; wherein that learned Gentleman has quoted various Authors, to account for divers muſcular Motions of the Face, which ſeem to me ſo rationally deſcribed, as being founded on the Structure of the Parts; tho' ſome, perhaps, will think, they are entirely built upon Hypotheſes. For my own Part, I freely confeſs, they are as probable as the Circulation of the Blood, which no Body doubts of.

See his Human Phyſiognomy explained, in the Crounian Lectures on Muſcular Motion, for the Year 1746; read before the Royal Society. Printed for C. REYMERS and L. DAVIS, over-againſt Gray's-Inn-Gate in Holbourn; Printers to the Royal Society.

Beſides this, the learned World are indebted to this Gentleman for ſeveral Obſervations and Diſcoveries which he has made, in Phyſiology, Natural Hiſtory, &c. which are diſperſed in the Philoſophical Tranſactions.

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* There are now in the Preſs, of the ſame Author, *Phyſiologiæ Corporis humani Elementa*, 2 Vols. 4to. *Synopſis enumerationis Methodicæ Stirpium Helveticarum, emendata, aucta. Bibliotheca Anatomica, Botanica, Chirurgica, Practica, & Hiſtoria Naturalis. Orchidis Genus conſtitutum, pene elaboratum cum iconibus ad Comm. Gott. Tom. V. Collectio.*

The

The Art of Preparing and Preſerving the Parts of Human Bodies; with that of Injecting their Veſſels: According to Profeſſor Monro's Method.

THE modern Invention of filling the Veſſels of Animals with a coloured Fluid, which, upon cooling, grows hard, has contributed greatly to the Improvement of Anatomy; not only by giving us an Opportunity to examine their Diſtribution, Situation, &c. but alſo by diſcovering a great Number of Veſſels, which, without this Art, we ſhould never have been acquainted with.

The Manner of filling the larger Trunks is known to moſt Anatomiſts; but few are acquainted with the Art of filling the capillary Veſſels: Therefore I ſhall lay down that which I have found (after many Trials) to be moſt ſucceſsful; and communicate all I know, of this Affair, without Reſerve.

The Inſtrument uſed in injecting is, a well-made braſs Syringe, to which ſeveral Pipes, of various Diameters, are fitted, and can be fixed by ſcrewing them into the Body of the Syringe: The other Ends of theſe Pipes are entirely ſmooth, and exactly fitted to the Pipe which is put into the Blood Veſſel, that, when both are preſſed together, nothing can paſs between them: To prevent the

latter from being forced off by the Injection, a crofs Bar is faftened to it, which is to be held with the Fingers, and preffed clofe to the Pipe that is fcrewed into the Syringe; the Ends of this fecond Sort of Pipes are of different Diameters, and round each a Notch or Groove is made, for admitting the Thread that ties it to the Blood Veffel, fo that it may not flip out. Befides thefe Pipes, one with a Valve, or Stop-cock, is neceffary in filling the larger Veffels, to hinder the injected Liquor from running back; but it is ftill more ufeful, when the Veffels to be injected require more Liquor than the Syringe will contain at once: For, by turning the Cock, you may keep in the Injection while the Syringe is filled a fecond Time.

As to the Fluid to be injected, it is varioufly compofed: The different Kinds of Glue, as Ichthycolla, Size, &c. diffolved, mix eafy, and pafs into very fmall Veffels, and will do very well in preparing a fine Membrane, where the Veffels are fo fmall that the Eye cannot difcover whether the tranfverfe Sections are circular, or their Sides collapfed: But this Injection will not anfwer your Purpofe when the larger Veffels are to be prepared; for, before the Glue will dry, the Subject will be fpoiled. To prevent this, you may foak the Part in Spirit of Wine; but then the Injection becomes fo brittle, that it will crack with the leaft handling; and if the Preparation is to be kept, the larger Veffels appear fhrivelled, when the watery Part is evaporated.

The Method which I have found to fucceed beft is, firft to inject fo much coloured Oil of Turpentine as will fill the fmall Veffels, and afterwards to force the common Injection into the larger ones: The Oil will pafs into fmaller Tubes than the Colour in it can, and its refinous Parts will give a fufficient Adhefion to the Particles of

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the Colour, and prevent their separating; and this fine Injection mixes with the coarser so intimately, that you cannot discover that two Sorts were used.

The Colours used by Anatomists are various. Those I use are red, green, and sometimes blue. In the red Injection is put Vermilion, which gives a beautiful bright Colour, and is to be bought finely levigated: In the green we use distilled Verdigrise, because the Colour is brighter than the common Sort, and never runs into Knots, and dissolves in oily Liquors.

To make the fine Injection, pour a Pint of Oil of Turpentine on three Ounces of Vermilion, or Verdigrise, according to the Colour you want; stir them well, with a wooden Spatula, till they are thoroughly mixed, and then strain all thro' a fine linen Rag.

The coarser Injection is made thus: Take Tallow one Pound, white Wax five Ounces, Oil of Olives three Ounces; melt them over a gentle Fire, then add, of Venice Turpentine, two Ounces: When this is dissolved, sprinkle in, of Vermilion or Verdigrise, three Ounces; and then pass all thro' a warm linen Cloth. When you design to make it run far in the Vessels, add some Oil of Turpentine immediately before you use it.

The next Thing to be considered is, the Choice and Preparation of the Subject; for which observe the following Rules:

1. The younger the Subject is, the farther the Injection will go. 2. The more the Fluids have been exhausted in Life, the greater will be the Success of the Operation. 3. The less solid the Part, the more Vessels will be filled. 4. The more membranous and transparent the Parts are, the better the Injection will appear.

In preparing a Subject the principal Things are; to dissolve the Flu[illegible] empty the Vessels, relax

relax the Solids, and prevent the Injection cooling too ſoon. Firſt, Macerate the Body or Part to be injected, a conſiderable Time in Water, ſo warm, that you can hold your Hand in it, which will relax the Veſſels, diſſolve the Blood, and keep the Injection from hardening too ſoon; whereas, if the Water be too hot, the Veſſels ſhrivel, and the Blood coagulates. From Time to Time ſqueeze out the Fluids at the Apertures by which the Injection is to be made. The Maceration ſhould always be in Proportion to the Age and Bulk of the Subject, and the Quantity of Blood obſerved in the Veſſels: Particular Care muſt alſo be taken, to make the Subject, or Part, perfectly warm throughout, and to preſs it, with the Hands, till no more Blood can be forced away.

All Things being thus prepared, chooſe a Pipe a little ſmaller than the Diameter of the Veſſel, and introduce it at an Inciſion made in its Side, and then, with a waxed Thread, ſecure it from ſlipping out.

If there have been any large Veſſels cut, which communicated with thoſe you intend to inject; or if there are any others, from the ſame Trunk, which you do not chooſe to fill; let them be carefully tied, which will ſave the Injection, and make the Operation ſucceed the better. When this is done, warm both the Injections, ſtirring them all the While: The Oil of Turpentine ſhould be no warmer than what you can bear your Finger in; the other Injection muſt be near boiling. The Syringe ſhould be made very hot, by drawing boiling Water into it; and the Pipe within the Veſſel may be heated with a Sponge dipped in boiling Water. A coarſe Cloth muſt be wrapped round the Syringe; otherwiſe you will not be able to hold it. Things being thus far prepared, fill the Syringe with the finer Injection, and then intro-

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duce the Pipe of the Syringe into that of the Veſſel, and preſs them together, holding this laſt Pipe firm with the left Hand, and griping the Syringe with the other; then preſſing your Breaſt againſt the Sucker, gently force it down. The Injection ſhould be thrown in ſlowly, and with no great Force, and proportioned to the Length and Bulk of the Part, and the Strength of the Veſſels.

When you have puſhed the Sucker ſo far that you are ſenſible of a Reſiſtance that would require a conſiderable Force to overcome; draw it a little back, in order to empty the neareſt large Veſſels; then take the Syringe away, and force out the fine Injection, and immediately fill it with the coarſer, which muſt be thrown into the Veſſels quickly and forcibly; having always Regard to the Strength of the Veſſels, &c. Continue to force in the Injection till you feel a full Stop, when you muſt deſiſt; otherwiſe the Veſſels will burſt, and the Whole, or Part, of the Preparation, be ſpoiled. You muſt always remember to keep the Syringe in the Pipe which is faſtened to the Veſſel, till the Injection is grown cold; when there is no Danger of its running out.

This Way I have injected the cortical Part of the Brain, Tunica Choroïdes and Vaſculoſa of the Eye, Perioſteum of the Bones of the Ear, Veſſels of the Teeth, and Tunica Villoſa of the Inteſtines.

The Difficulties of preparing and preſerving the Parts of animal Bodies for anatomical Uſes, are apt to diſcourage young Beginners from proſecuting this uſeful Art with due Application: To facilitate their Labours, which may poſſibly contribute to the Improvement of Anatomy, I ſhall lay down the Methods which I have found the moſt ſucceſsful.

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The chief Preparation of the Bones is, to make them white, and this may be done by macerating them in cold Water (which ſhould be often changed), and then putting them to dry in the Sun; taking particular Care not to let them lie too long in the Water, leſt the moſt ſpongy Parts be deſtroyed, or the Epiphyſes ſeparated. If the Bones are of a young Subject, and if they are ſuffered to dry, before the Blood is entirely taken away; they will never be white.

The Bones of young Animals, as they have leſs Oil, will be whiter than thoſe of old ones, and will not ſo ſoon turn yellow.

The Bones of Fœtuſes ſhould be frequently taken out of the Water, and the Perioſteum ſuffered to remain on at the Epiphyſes.

Cartilages are prepared as the Bones are, but muſt be brought to, and kept in, their proper Shape, by Strings, Weights, and the like, whilſt they are drying.

The Muſcles are to be laid in the Poſture which they are intended to be preſerved in, and, as they are drying, preſſed into their natural Shape.

When you have injected the Blood-Veſſels, according to the Method laid down in the following Article, macerate the Part in cold Water, till the Blood is all extracted; then ſqueeze all the Water out of it, and hang it up to dry a little in the Air, before you put it into the Spirit in which it is to be preſerved.

But there is ſtill farther Art requiſite to ſhew very minute Veſſels, which is as follows; viz. Put the Part into Water, and there let it remain till the involving Membrane is raiſed from it, which you muſt ſeparate, and remove quite away, ſuffering the other Part to lie in the Water, till the Fibres are diſſolved, which may be known by ſhaking the Part in the Water, which waſhes the

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corrupted Particles off by Degrees; and, at last, the small Vessels will appear distinct, floating in the Water: Then take the Preparation out, drain all the Water from it, and suspend it in the Middle of a Glass (which is to be filled with the preserving Liquor) by a Thread or Hair.

I could never divide Nerves into their very small Filaments, after they were involved in the Dura Mater; but, before, it is easily done.

Those that make up the Cauda Equina, are best for this Purpose: Cut one of these Cords thro', where it comes from the Medulla Spinalis, and is about to enter the Dura Mater; pass a Horse Hair thro' one End of it, and suspend it in Water for some Time; when it is well macerated, raise it to the Side of the Bason, and draw a small Needle lightly along it; continue this Operation, till, upon twirling the Nerve in the Water, you see it expanded into a fine Web of Fibres; it is then fit to be put into the Spirit. If the Blood-Vessels are first injected, tie the Hair to the End nearest the Dura Mater, that the Trunk of the Nerve and Artery may be seen together.

The Cauda Equina, thus prepared, appears very beautiful, the injected Vessels running almost upon each Filament of the Nerve.

When a fine Membrane, such as the Pleura, is to be preserved, in order to shew the Arteries, after Injection; as much of the cellular Membrane should be saved as can be, without spoiling the Transparency: For when it is wholly removed, few continued Ramifications are to be seen. When there is but little Fat in the Cells, the Membranes, if left, cannot be easily discerned; and, if there is much Fat, it must be pressed out as clean as possible, and the Part well macerated.

In Membranes, which are to be preserved wet, the Vessels will appear much plainer, if they are first

first dried, and afterwards put into the Liquor. To do this, extend them, with Pins, on a smooth Board; and, when they are dry, cut off the doubled Edges, and other Inequalities, with Scissars. RUYSCH separated the Cuticula and Corpus Reticulare from the Skin by stretching the Integuments on a Board, and then dipping them into scalding Water; by which the Cuticula and Corpus Reticulare were loosened, and then easily separated from the Skin by the Handle of a dissecting Knife; as may be, also, the Corpus Reticulare from the Cuticula: Afterwards, they may either be kept dry, or in Spirit of Wine.

The Cuticula of the Hand or Foot may be taken off entire, after it is loosened by Putrefaction; and this Method is preferable to the former.

The Membrana Cellularis cannot be kept inflated, unless it has little or no Fat. The best Part, for a Preparation of this Kind, is the Scrotum; which, by Inflation, may be changed into fine membranous Cells. CAR. STEPHANUS says, that the cellular Membrane in any other Part appears muscular when the Fat is gone.

These Observations will serve as an Apology for some Anatomists, who reckon a Tunica Caricosa among the common Integuments of the Body.

To preserve the Dura Mater in its natural Situation, you must first saw the Cranium from the Nose to the Occiput perpendicularly, and afterwards by an horizontal Section, terminating at the Extremities of the former; remove a great Share of one Side of the Cranium, then open the Dura Mater by an Incision in the Form of a T, clear the Head of all the Contents, and preserve it in Spirit of Wine, or dry it in the Air, taking Care to keep the Dura Mater from shrivelling.

If the Head of a Fœtus is to be thus dried, the Membranes between the Bones muſt be kept from contracting, by putting little Sticks, of a proper Length, into the Cranium, ſo as to prevent the Bones from approaching each other. The Proceſſes of the Pia Mater are eaſily ſeparated entire with it, when this Membrane (which frequently happens) is much thickened; and, even in a natural State, large Pieces of it, with its Proceſſes, may be ſeparated, after proper Maceration. When it is quite freed from Water, put it into the Spirit of Wine, taking Care to keep it properly extended.

Before you can prepare the Eye ſo as to demonſtrate all its Parts, you muſt coagulate the cryſtalline and vitreous Humours, by putting them into a convenient Liquor; after this, macerate it, for ſome Time, in Water, and then you will eaſily ſeparate the choroïd Tunic, and alſo Ruysch's. The Glands and Ducts of the Palpebræ are better ſeen after the Arteries are injected, and the Liquors coagulated, than in a freſh Subject.

By macerating the Ear in Water, the Membrane which lines the Meatus Auditorius Externus, and forms the external Lamella of the Membrana Tympani, ſeems to be compoſed of this Cuticula, and the Membrane which lines the Tympanum, joined by a cellular Subſtance in which the larger Branches of the Veſſels are diſtributed.

The Cuticula of the Lips is eaſily taken off after Maceration, which much improves the villous Appearance, when the Lips are afterwards put into Spirit of Wine.

The villous Subſtance of the Tongue is made quite red by a proper Injection, and a Membrane analogous to the Cuticula ſeparates from it by Maceration; and, indeed, the Lips, Tongue, Oeſophagus, Stomach, and Inteſtines, ſeem to be

covered with this Sort of Cuticula which is faſtened to the muſcular Part by a cellular Subſtance that contains the Nerves, Blood-Veſſels, Glands, &c. this forms Valves, or Rugæ, where it is thick and looſe; but looks like a fine Membrane where it is thin and ſtretched.

There are no Parts of the Body ſo difficult to have a good Idea of, as thoſe ſubſervient to Deglutition; as neither a recent Body, nor a wet Preparation, can ſhew them tolerably exact. The beſt Way is, to ſhew the larger Parts in a dry Preparation, which requires great Patience to execute well. For, after all the Muſcles are neatly diſſected, they muſt be cut off from the ſurrounding Parts, and removed, together with the Tongue, Os Hyoïdes, Fauces, Velum Palati, Uvula, Larynx, &c. and then placed and kept in their natural Situation, with Pins or Threads, orderly faſtened to a Board: Then put a Cork into the lower Part of the Trachea, and tie that and the Oeſophagus firmly together, and fill the Oeſophagus, Trachea, &c. with Quickſilver; in which Condition hang the Whole up till the Parts are pretty firm, but not quite dry; when the Quickſilver ſhould be poured out, and the Parts which are over-ſtretched ſhould, by ſqueezing and preſſing, be brought to their natural Situation; and ſuch as are too much ſhrivelled pulled out, from Time to Time, to their natural Shape, till they are quite dry.

The hollow Viſcera of the Thorax and Abdomen ought to have their Veſſels firſt injected, and, when they are to be preſerved dry, filled with a convenient Matter, to prevent their ſhriveling as they dry, and which afterwards may be eaſily removed.

The beſt Methods are, either blowing them up, or filling them with Quickſilver, or melted Wax: The

The laft is only proper to fhew the exterior Surface; in all other Cafes, ufe either Air or Quickfilver. I prefer the firft; for it ftretches all Parts equally; but Quickfilver preffes moft on the depending Parts: Befides, the Inteftines which are inflated dry in much lefs Time than thofe which are filled with Quickfilver; but if the Parts are fuch as will not retain the firft, they muft be prepared by the latter.

In preparing the Oefophagus, Stomach, Inteftines, &c. you muft make Ufe of Air; but in preparing the Pericardium, Uterus, &c. Mercury is neceffary; as alfo in the Heart with its Blood-Veffels, and the Pelvis of the Kidney with the Ureter.

The Corpora Cavernofa and Veficulæ Seminales retain both; but Mercury leaves a Tinge, which hinders a clear View of the Structure of the Parts; and it is alfo difficult to fill the Veficulæ Seminales with it: For when it is poured into the Vas Deferens, it is liable to be ftopped by the Moifture of this Tube; and, when it is not, it often forces its Way into the Urethra, and never mounts into the Veficula till the Urethra is quite filled: Whereas the Air, when gently blowed in, eafily rifes into the Veficula, as it has not Force enough to open the Orifice in the Urethra.

The Lungs or Spleen will feldom retain Air; nor will the Glans of the Penis always do it: Therefore, for thefe Parts, we generally make Ufe of Quickfilver. But this does confiderable Damage to the Lungs and Glans, as the Cells are fmaller than thofe of the Spleen.

When we have once fixed upon our Liquors, Care fhould be taken to clear the Parts, intended to be filled, of their Contents, and to fecure all the Openings except that through which we intend to pour the Liquors. This Paffage fhould be fuch

as will beſt and ſooneſt admit the Fluid into every Part of the Cavity you intend to fill, and which is eaſieſt to be ſecured afterwards. The Place proper for inflating the Inteſtines, Veſica Fellea, and Urinaria, every Body knows. The Heart and large Arteries are eaſily filled thro' the Vena Cava, or pulmonary Veins; the Lungs by the Trachea Arteria; the Kidney by the Ureter; the Spleen by the Capſula Atrabilaris, and the Corpora Cavernoſa Penis by their proper Veins.

For inflating any of the Veſſels, a Pipe with a Notch at the End, with a Stop-cock above it, is moſt convenient. Introduce the ſmall End into the Opening, and with a waxed Thread tie the Veſſel to the Pipe exactly over the Notch, which will prevent its ſlipping: When you have ſufficiently inflated the Part, turn the Cock, and leave it to dry. If you make Uſe of a common Blowpipe, you muſt get an Aſſiſtant to make a Ligature on the Veſſel below the Pipe when the Part is ſufficiently diſtended. If Quickſilver is uſed, the Paſſage thro' which it is poured muſt be higher than the reſt of the Preparation; and when the Paſſage is narrow, a ſmall Glaſs Funnel or Pipe is convenient, which muſt be long, where the Weight of a Column of Quickſilver is neceſſary to fill the minute Veſſels.

If the Part will allow it, this Paſſage ſhould be tied firmly, or elſe kept always uppermoſt till the Preparation be quite dried. When a large Quantity of Quickſilver is poured into a Part of a tender Texture, the upper Part of it ſhould be ſuſpended by Threads and Hooks, and the inferior Part ſupported by a ſmall Net ſpread under it.

The Directions before given are ſufficient for preſerving the greateſt Part of the Viſcera; but the Lungs and Spleen require more Care, as Quick-

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ſilver or Air will eaſily eſcape through their Membranes.

Theſe Parts ſhould be taken from ſuch Animals as have the exterior Membrane of theſe Viſcera thick and ſtrong: After they are diſtended, dry them in the Sun, or before a moderate Fire, taking Care, if they ſubſide, to inflate them a-new. As ſoon as the Surface is dry, cover them with Turpentine Varniſh, which will prevent the Air from eſcaping, and dry them thoroughly with all poſſible Expedition. When the human Spleen has been thus diſtended and dried, you will find it compoſed of Cells, communicating with each other, with ſeveral Branches of an Artery ſpread upon the Sides of them, if the Arteries be firſt injected. If the Lungs, thus prepared, are cut, the Veſicles appear to be Polygons, for the moſt part irregular Squares and Pentagons; and one might conclude, that they are more ſo in a living Animal; for the exterior Membrane is of a Texture ſtronger than the Veſicles, and will keep them from being extended ſo much as they are capable; and therefore they muſt preſs againſt each other, and form a Figure of as many Angles and Sides, as there are contiguous Veſicles; and then the Thorax does not admit the Lungs to be diſtended as far as the exterior Membrane will allow: Conſequently, the Veſicles muſt be more compreſſed, and the Sides ſtreightened, in Reſpiration, than when they are diſtended after they are taken out of the Body.

Theſe Conſiderations, and the plain polygonous Form of the Cells in the Lungs of Serpents, Frogs, &c. make it ſurpriſing that the Veſicles of more complicated Lungs ſhould be taken to be ſpherical, or any Figure whoſe tranſverſe Section is circular.

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The Manner of preferving Preparations, is either by drying them thoroughly in the Air, or putting them into proper Liquors. In drying Parts which are very thick, when the Weather is warm, you muft take Care to prevent Putrefaction, Fly-blows, Infects, &c. from deftroying them; which is eafily done, by foaking the Part in a Solution of corrofive Sublimate in Spirit of Wine, made in the following Proportion; viz. Spirit of Wine, one Pound; Mercury Sublimate, two Drachms. The Part fhould be moiftened with this Liquor as it dries. By this Method, the Body of a Child may be fafe kept, even in the Summer.

As dried Preparations are apt to crack, and moulder away, in keeping; you fhould cover the Surface with a thick Varnifh, and repeat this as often as there is Occafion. Though feveral Parts prepared dry are ufeful, yet feveral others muft be fo managed, as to be always flexible, and nearer a natural State. The Difficulty has been, to find a proper Liquor for this Purpofe. The beft which I know, is a well-rectified colourlefs Spirit of Wine; to which I add a fmall Quantity of Spirit of Vitriol, or Nitre.

When thefe are properly mixed, they neither change their Colour, nor the Confiftence of the Parts, except where there are ferous or mucous Liquors contained in them. Even the Brain of a young Child, in this Mixture, grows fo firm, as to admit of gentle Handling; as do, alfo, the vitreous and cryftalline Humours, &c. of the Eye: The Liquor of the febaceous Glands, and the Semen, are coagulated by this fpirituous Mixture. It heightens the red Colour of the Injections of the Blood-Veffels, fo that, after the Part has been in it a little Time, feveral Veffels appear, which were before invifible.

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If you compare theſe Effects with what Ruysch has ſaid of his Balſam, you will find, that the Liquor before mentioned comes very near to it.

The Proportion of the two Spirits muſt be changed according to the Part prepared. For the Brain, and Humours of the Eye, you muſt put two Drachms of Spirit of Nitre to one Pound of Spirit of Wine: In preſerving other Parts which are harder, thirty or forty Drops of the Acid will be ſufficient: A large Quantity will make Bones flexible, and even diſſolve them.

The Part, thus preſerved, ſhould be always kept covered with the Liquor: Therefore be very careful to ſtop the Mouth of the Glaſs with a waxed Cork, and a Bladder tied over it, to prevent the Evaporation of the Spirit; ſome of which (notwithſtanding all this Care) will fly off: Therefore you muſt add freſh, as you ſee Occaſion. When the Spirits change to a dark Tincture, which will ſometimes happen, pour them off, and put freſh in their Room, but with ſomewhat leſs acid than at firſt.

As for the Glaſſes which contain your Preparations, they ſhould be of the fineſt Sort, and pretty thick; for through ſuch you will ſee the Parts very diſtinct, and of a true Colour: And the Object will be ſo magnified, as to ſhew Veſſels in the Glaſs, which out of it were not to be ſeen.

As the Glaſs, when filled with the Liquor, has a certain Focus, it is neceſſary to keep the Preparation at a proper Diſtance from the Sides of it; which is eaſily done, by little Sticks ſuitably placed, or by ſuſpending it, with a Thread, in a proper Situation.

I ſhall finiſh theſe Directions with cautioning the Operator from putting his Fingers in this

Liquor oftener than is abſolutely neceſſary; becauſe it brings on a Numbneſs on the Skin, which makes the Fingers unfit for any nice Operation.

The beſt Remedy for this, which I know of, is, to waſh them in Water mixed with a few Drops of Oil of Tartar per Deliquium.

A Synopsical Exposition of the Parts of the Human Body, as they are gradually met with in Dissection.

THE Dexterity of the Hand would be of very little Service, in diffecting the Human Body, if the Operator was ignorant of the Parts which he meets with in his Preparations.

They prefent themfelves in fo great a Number, that one would be at a Lofs fometimes how to begin, if the Perfon has not had proper Inftructions, to ferve him as a Guide.

Books are of very little Help; becaufe the moft methodical Order, that is found in them, is always very remote from that the Author of Nature has kept, in the Difpofition of an infinite Number of Pieces which are the Conftruction and Frame of a Machine that feems to be the moft beautiful Work of the whole Creation.

It is for the Sake of thofe, whofe Knowledge does not correfpond with their Good-will, that the Perufal of this Introductory Difcourfe is intended. What it contains will guide them by the Hand, and let them know, at once, all the Parts that might ftop them in their Diffections.

We have thought proper only to point them out; becaufe if one defired any farther Inftructions, he might confult the Lecture, that defcribes them fuller. We fhall not mention any of thofe Parts whofe Affinity is not equivocal; as thofe of

the Brain, Eyes, Ears, Mouth, Organs of Generation, &c. becauſe they have been comprehended in one ſole Article; intending only to name thoſe Parts, whoſe Situation, Uſe, and Nature, may throw him, that diſcovers them, into Errors and doubtful Ideas, which may be a Hindrance to his Progreſs.

We ſhall be obliged to begin our Expoſition by the anterior Part of the Neck; becauſe one ought to have prepared upon that Part many Nerves, Veſſels, and Muſcles, which we ought to obſerve in the Head. We ſhould not be underſtood, if we followed another Courſe; and ſhall divide this Expoſition into ſeven Articles.

The firſt will contain all the Parts that one meets in the anterior Part of the Neck; the ſecond will treat of the Head; the third of the external Parts of the Trunk; the fourth of the Thorax; the fifth of the Abdomen; the ſixth of the ſuperior, and the ſeventh of the inferior Extremity.

I. The Neck seen anteriorly. A very large cutaneous Muſcle is the firſt Part one diſcovers on it; after it is raiſed, we ſee, without any other Preparation, the external Jugular, which is commonly double: This Vein runs laterally on the Neck, to empty itſelf into the ſubclavian Vein; and is ſuſtained by a very conſiderable Muſcle, that goes obliquely from the Sternum towards the poſterior Part of the Ear, called Maſtoïdes.

We muſt conſider, before we proceed any farther on the Neck, three ſolid Parts, to which may be referred the Situation of the greateſt Part of thoſe to be mentioned hereafter; viz. the Larynx, Trachea Arteria, and Os Hyoïdes.

The

The Trachea Arteria is a Canal compoſed of cartilaginous Segments, eaſily diſcovered in the anterior and inferior Part of the Neck: It is almoſt covered by the Muſcles and Glands, as will be mentioned hereafter; but its cylindrical Figure and Solidity make it very plain to be ſeen.

The Larynx is ſituated upon the Trachea Arteria, and is the Origin of it: It is anteriorly formed of two cartilaginous Pieces; and the moſt conſiderable of the two, which is the ſuperior one, is called the thyroïd, and the ſecond the cricoïd Cartilages.

The Thyroïdes is very remarkable, by its Sally: It is commonly called the Apple of ADAM. The Cricoïdes is of an annular Figure, which ſerves as a Baſis to the firſt. The Os Hyoïdes, ſituated above the Larynx, is inveſted with many Muſcles that terminate on it: Its Solidity makes it very conſpicuous; and one may, by feeling it, very plainly diſcover its Form and Extent externally.

The two Muſcles ſituated upon the Trachea Arteria are called Sterno-hyoïdes, and Sterno-thyroïdes: The firſt, or external one, aſcends to the Larynx, and is inſerted at the Os Hyoïdes; the ſecond, which is under the former, terminates to the thyroïd Cartilage.

If theſe Muſcles be raiſed, two ſmaller are diſcovered upon the Larynx; of which, the ſuperior is the Thyro-hyoïdæus, and the inferior has been called the anterior Dilatator. There is beſides, on the Trachea Arteria, a very conſiderable Gland called Thyroïdes, which commonly forms but one ſingle Maſs, and is ſometimes divided into two.

Next to the preceding Muſcles is met a thin one, that goes obliquely from the Omoplata to the Os Hyoïdes: It runs behind the Maſtoïdes and external Jugular, and aſcends afterwards before the

the internal Jugular and the other Parts it meets in its Way. It is what is commonly named Coraco-hyoïdes.

The firſt Thing we diſcover under the Chin, is the anterior Portion of the Digaſtricus; then, after having ſeparated it from the inferior Maxilla, is ſeen a pretty large Muſcle called Mylo-hyoïdæus, behind which is ſeen the Genio-hyoïdæus. After we have turned back upon the Larynx, it at once preſents to our View ſeveral Parts; viz. 1. The maxillary Gland. 2. The ſublingual. 3. The Genio-gloſſus. 4. The Hyo-gloſſus. 5. The Nerve of the ninth Pair. The Glands are all placed behind the inferior Margin of the inferior Maxilla, the maxillary Gland is placed near the Angle of that Bone, the ſublingual is not far from the Chin, the Genio-gloſſus and its ſimilar Gland are ſituated between the two Sublinguales, and the hyo-gloſſal Muſcle, more conſiderable than the former, ſuſtains the Nerve of the ninth Pair that runs thro' it.

After having ſeparated the Maſtoïdes from the Clavicula, and the Coraco-hyoïdæus from the Omoplata, we obſerve two very conſiderable Veſſels ſituated by the Larynx and Trachea Arteria; viz. the external Jugular, and the Trunk of the carotid; eaſily diſtinguiſhed by their Colour and Subſtance.

The Jugular receives, near the Superficies of the Larynx, a very conſiderable Vein, which comes from the Concourſe of thoſe that run from the Larynx, Tongue, Face, &c. the Trunk of the internal Jugular paſſes afterwards behind the poſterior Portion of the digaſtricus Muſcle, between the internal Carotid and the Diviſions of the external. We meet in that Place, I mean behind the poſterior Portion of the Digaſtricus, a conſiderable Nerve that penetrates the poſterior Side

of

of the Maſtoïdes: It is called the ſpinal or acceſſory Nerve of WILLIS.

At the ſuperior Part of the Larynx is ſeen the Diviſion of the carotid Artery into external and internal: The internal is carried, by the Side of the Jugular, as far as the Baſis of the Cranium, and is loſt at the Diſtance of an Inch of that Diviſion; the external, before it arrives at the End of the Baſis of the Maxilla, gives Riſe to five pretty conſiderable Veſſels; viz. 1. The Larynx, which is not remote from the Diviſion of the Carotid. 2. The Sublingualis that runs thro' the hyo-gloſs Muſcle. 3. The external Maxillary that paſſes behind the digaſtric Muſcle, Sterno-hyoïdæus, Nerve of the ninth Pair, and runs thro' the maxillary Gland to aſcend to the Maxilla, where we ſhall again take Notice of it hereafter. Theſe two laſt Arteries ariſe from the ſame Trunk. 4. The Occipital, which is external, contrary to the three firſt that are towards the Larynx: It paſſes behind the eighth Pair of Nerves and Digaſtricus before the external Jugular, to be carried towards the Occipital, in inſinuating itſelf under the ſuperior Heads of the Maſtoïdes, Splenius, and Longiſſimus Dorſi. 5. The Stylo-maſtoïdæus, that ariſes ſometimes from the occipital Trunk. Behind the Digaſtricus, known by its middle Tendon, is ſeen a thinner Muſcle that goes towards the Os Hyoïdes, called Stylo-hyoïdes; under this laſt one perceives always, upon the Diviſions of the external Carotid, a pretty conſiderable Nerve, that runs almoſt parallel with this Muſcle; it is that of the ninth Pair which we have already mentioned. The common Trunk of the Carotids inveſts all along the anterior Part of the Neck, two very conſiderable Nerves, the Intercoſtal, and Par Vagum. The firſt, which is internal, increaſes in Bigneſs above the Diviſion of the

the Carotid, and forms, from that Place to the Baſis of the Cranium, a very conſpicuous elongated Tumor, called the ſuperior cervical Ganglion; the Nerve of the vagal Pair is a whiter Cord, and has more Solidity: If one ſeparates inferiorly the Trunk of the internal Jugular, there is ſeen, on the anterior Side of the firſt Portion of the Scalenus, a pretty conſiderable Nerve, called Diaphragmatic. There appears afterwards many Muſcles that ariſe from the Vertebræ of the Neck: The moſt anterior ones are, the Rectus Major, Capitis Anterior, and Longus Colli; the firſt, which is external, wraps over a Part of the other.

In the inferior Parts of the Neck, and behind the Clavicula, the two anterior Portions of the Scalenus are very remarkable: You may eaſily diſcover their ſuperior Heads and Inſertions, if the Anterior Major be removed a little, and you raiſe it. Behind the ſuperior Part of the Scalenus is found another very conſiderable Muſcle; it is what is commonly called Elevator Omoplata, and riſes from the tranſverſe Apophyſes of the ſuperior Vertebræ of the Neck. We muſt free a little and raiſe the Scalenus, to have a full View of them. Above the tranſverſe Apophyſis of the firſt cervical Vertebra, where ends the ſuperior Portion of the Elevator, is ſeen a very ſhort Muſcle, called Rectus Lateralis; and behind the Elevator a Portion of the Splenius is ſeen, which terminates on that Side towards the maſtoïd Apophyſis, and to the tranſverſe of the firſt Vertebra.

Beſides the Nerves already named, we meet with a great many more that ariſe from the Medulla Spinalis between the cervical Vertebræ; they are the Nerves called Occipitales and Cervicales. The firſt give a remarkable Branch under the internal Margin of the Rectus Lateralis, ſoon after which they

they meet the Par Vagum and Intercoſtal, with both which they communicate; they alſo ſend off a Filament that deſcends before the tranſverſe Apophyſis of the firſt Vertebra, and communicates with the firſt cervical Pair.

Afterwards the Nerve of the firſt cervical Pair is perceived, a very remarkable Cord, that ariſes poſteriorly, and paſſes under the internal Margin of the firſt Head of the Elevator Omoplata; then the ſecond, third, and fourth, cervical Pair appear, and in that Order: You need only pull aſide the Fibres of the Scalenus to have a full View of them. For the others, we muſt deſtroy the ſuperior Head of the firſt Portion of the Scalenus, in order to ſhew them, by putting them back upon the Clavicula. Then is diſtinctly ſeen the four laſt cervical Pairs that form a ſingle Plane, and re-unite, at the Diſtance of an Inch, to form the Plexus, whence the brachial Nerves ariſe; and may even ſee, under the laſt cervical Pair, the Nerve of the Primi Dorſalis that connects with it. Under this nervous Plexus a great Artery is ſeen that has almoſt the ſame Direction; it is the ſubclavian.

2. The Head. Its Parts are reduced to a ſmall Number, if we omit the Brain, Eyes, Ears, Noſe, and many internal Parts of the Mouth.

There is ſcarce any Place but the Face where one meets with Muſcles, Glands, Nerves, and Veſſels, that may create ſome doubtful Ideas. We ſhall confine ourſelves, then, to conſider it relating to all its Parts that we ſhall name in the Order they will preſent themſelves.

The Face. The greateſt Part of the Muſcles of the Face are cutaneous, therefore the Skin muſt be raiſed with a great deal of Care, ſo as not to deſtroy the Muſcles. The Forehead is occupied by

by the anterior Portion of the Ciliares Majores; the Ciliares Minores are placed next to the Root of the Noſe, under the Eye-brow; the Orbicularis Palpebrarum is a large muſculous Spanſion which ſurrounds thoſe Productions of the Skin, or that ſuſtains them; upon the lateral Side of the Noſe is ſeen the Obliquus Deſcendens Muſcle; the Inciſive is not far from the inferior Part of the Noſe; the Angulare Arteria runs upon that Muſcle. If we raiſe the inferior Extremity of the Obliquus Deſcendens, and the Inciſorius, we diſcover the Myrtiformis; the Caninus lies under the Inciſive, towards the Lips; the Orbicularis Labiarum is that muſculous Maſs which forms the Thickneſs of them: The Zygomatic, which is often double, goes obliquely from the temporal Arch to the Angle of the Mouth. Under the former is perceived, between the Maxilla, a pretty large Muſcle called Buccinator; it is the deepeſt Muſcle belonging to the Mouth: From the Buccinator, towards the Chin, we meet, 1. The Triangulares. 2. The ſuperior Extremity of the Muſcle lying on the anterior Side of the Neck. 3. The Muſcle of the Chin placed under the inferior Lip. Upon the lateral Part of the Cranium, above the temporal Curvature, is ſituated a very conſiderable Muſcle called Crotaphites, that ſuſtains the temporal Artery; above the cartilaginous Part of the external Ear lies its ſuperior Muſcle; the Space between the temporal Arch, to the Portion of the Baſis of the Jaw Bone anſwering to it, is occupied by the Maſſeter. Between this laſt and the Ear is ſituated a very conſiderable Gland, which is the parotid; its Duct goes to the Maſſeter, and tranſverſly to the Buccinator, which it runs through: Between the maſſeter and triangular Muſcle we find the internal maxillary Artery. If we raiſe the maſſeter from the

the zygomatic Arch, we may diſcover, by the Opening that is between the coronoïd of the Maxilla and its Head, the ſmall Pterygoïdæus and the Tendon of the Crotaphites: The Pterygoïdæus Major, which occupies the interior Side of the Maxilla that is parallel to it, covers the Maſſeter. To proceed any farther, we are obliged to ſaw off the inferior Maxilla near the Chin, deſtroy the Head of the Crotaphites, and alſo that of the Pterygoïdæus Major, that we may pull back that Portion of the Maxilla next to the Ear: Then is ſeen, very diſtinctly, the Branch of the fifth Pair, which inſinuates itſelf into the Sinus of the inferior Maxilla; afterwards the Pterygoïdæus Minor is plainly perceived: We muſt afterwards divide this from the Os Sphenoïdes, and do it with a great deal of Care, for Fear of hurting the Trunk of the maxillary Artery that runs thro' its Baſis, and to the Diviſions of the internal maxillary Nerve. We ought afterwards to obſerve the internal maxillary Artery that goes into it, with the Nerve juſt mentioned, which muſt both be cut at their Entry into the Maxilla, that we may carry off all that Portion of the Maxilla in deſtroying the Ligamentum Capſulare of the Articulation, where we perceive an inter-articular Cartilage, of which mention has been already made: Then we ſee that conſiderable Branch of the external Carotid which we have named maxillary, from which ariſe four Arteries; the internal maxillary, ſpinal, orbital, and naſal. The firſt is ſeen before you take off the inferior Maxilla; the ſecond is ſeen behind the nervous Cord that belongs to it; then the two laſt are eaſily conducted to the inferior Orbital or Opening, and to the ſpheno-palatin Foramen that receives them. We ſee again, in the Cavity that lodged the Pterygoïdæus Minor, the Branches of the inferior maxillary Nerve. The

two

two moft confiderable are, that which embraces the Pterygoïdæus Major, deftined for the Tongue; and the Nerve of the Maxilla. We muft obferve, that the maxillary Artery paffes, after having given Rife to the internal Maxillary and fpinal, between thofe two Nerves: The other Branches of the inferior maxillary Nerve expand themfelves, like a Web, upon the adjacent Parts. There is a very confiderable one that runs behind the Origin of the Maxillary; it penetrates the parotid, and goes upon the temporal Artery. The inferior Extremity of the Cotaphites receives one, lefs remarkable than the former ones; the others accompany the Divifions of the orbital and nafal.

If we pull back the Pterygoïdæus Major in the Cavity that was in the Minor, is feen, behind the Bafis of the firft, two Mufcles of the palatin Arch, whofe moft anterior is the concave Mufcle, very remarkable by its Tendon, that the Hook of the external Wing of the pterygoïd Apophyfis fuftains. The right one is fituated pofteriorly, tho' it appears to be the firft. Behind the carotid Trunk one ought to confider two Mufcles that arife from the ftyloïd Apophyfis; the anterior is the Stylo-gloffus, the pofterior is the Stylo-pharyngæus: Therefore there are two Mufcles in that Part, which have the fame Direction; viz. 1. The Digaftricus, or its pofterior Portion that goes towards the Os Hyoïdes. 2. The Stylo-hyoïdes, that commonly runs with the former. 3. The Stylo-gloffus, that goes towards the Tongue. 4. The Stylo-pharyngæus, that is, the deepeft. Under the Stylo-pharyngæus lies the Nerve of the ninth Pair that paffes before the Intercoftal, Par Vagum, and internal Carotid; then may be feen the Fibres of the pofterior Plane of the Pharynx, the Continuance of thofe Fibres with the middle ones of the Buccinator; we again

fee,

ſee, in putting the Pharynx aſide, the Rectus Major, and anterior Capitis, in all its Extent. If we divide it from the Baſis of the Cranium, you will directly ſee the Rectus Minor anterior. We have mentioned the Rectus Lateralis before.

The Head seen posteriorly. The Parts we meet with poſteriorly upon the oſſeous Cavity are, after the Teguments, 1. The aponeurotic Membrane, that covers not only a great Part of the Cranium, but alſo the poſterior Part of the Neck. 2. The Ciliares Majores; and, next to their occipital Fibres, the poſterior Muſcle of the Ear. 3. The Pericranium. There are alſo many Muſcles of the Omoplata, Back, and Head, that have their Origin in the Occiput; as we ſhall point them out.

3. The Trunk. We ſhall comprehend, under this Head, all that is fixed upon the anterior Part and Side of the Thorax and the Clavicle, with what forms the muſculous Circumference of the Abdomen from the cartilaginous Margin of the Frame of the Thorax to the Bones of the Pelvis. We ſhall afterwards examine the Back, and poſterior Part of the Neck that we cannot ſeparate.

The Trunk seen anteriorly. The Pectoralis Major is a Muſcle that belongs to the Arm, and occupies a great Part of the anterior Side of the Thorax; it forms a Plane continued with the Deltoïdes, that ſurrounds the ſuperior Part of the Os Humeri, and appears with the former without any other Preparation. One ſees under the Pectoralis Major, upon the lateral Part of the Thorax, a pretty conſiderable Portion of the Serratus Major Anticus, and then the interior Margin of the Latiſſimus Dorſi that goes from under the Arm to the Oſſa Ilei. The remaining Part of the Space that we ought to conſider, is occupied by the Ob-

liquus Major, a Muſcle belonging to the Abdomen, and terminates its Circumference externally. Its ſuperior Extremity covers inferiorly a conſiderable Part of the Thorax: It cannot be ſeen, in all its Extent, when we conſider only the external Side of the Trunk, its poſterior Portion extending itſelf to the Extenſors of the Back. One ought to conſider, in the inferior Part of the Aponeuroſis Obliqui Majoris, the Annulus that gives a Paſſage to the ſpermatic Nerve, incloſed by the cremaſter Muſcle, and under it the inguinal Ligament that extends from the anterior and ſuperior Spines of the Pelvis to the moſt acute and extreme Part of the Os Pubis.

Thoſe are all the Parts that appear without Preparation, after having raiſed the Teguments: However, I think it neceſſary to obſerve, that we often meet, upon the Clavicles and the ſuperior Part of the Pectoralis Major, a Portion of the cutaneous Muſcle called Platyſma-myoïdes.

Behind the Pectoralis Major is met with the Veſſels that diſtribute themſelves into all its internal Side; viz. the thoracic ſuperior Artery, with its Vein, accompanied with ſome little Nerves. Theſe Veſſels cannot be well ſeen till the Pectoralis Major is pulled back, and alſo the anterior Portion of the Deltoïdes.

There appears then two other ſmaller Muſcles, called the Subclavian and Pectoralis Minor. The firſt is ſometimes wanting: When it is there, its Situation under the Clavicula makes it well known, relating to the Pectoralis Minor. It is placed immediately behind the Major, at a ſmall Diſtance from the cartilaginous Portion of the Ribs: We diſcover, beſides, a Portion of the Serratus Major that covers, with the Obliquus Major, all the lateral Side of the Thorax. One may obſerve the two Planes of the intercoſtal Muſcles: The internal

ternal appears between the cartilaginous Portion of the Ribs, the external being wanted in that Part: This is to be ſeen between the oſſeous Ribs, the Direction of the Fibres that compoſe them making them very conſpicuous. If the Obliquus Major be raiſed, a pretty conſiderable Portion of the Frame of the Thorax is diſcovered, and alſo the Obliquus Minor that fills pretty exactly the Space between the Margin of that Frame and that of the Pelvis. The tranſverſe is ſituated behind the Obliquus Minor; then follows the Peritonæum.

What we have ſaid, ought to be underſtood of the lateral Part of the Abdomen; for in its middle Part we may ſee, on both Sides, two other Muſcles, which are, the Recti and Pyramidales: They are both placed between the thin Laminæ of the Aponeuroſis of the Obliquus Minor. The Rectus extends itſelf from the Sternum to the Os Pubis; the Pyramidalis is only a few Inches long: They terminate in aſcending to the Linea Alba.

If we go thro' the Rectus, we ſhall diſcover, in its internal Side, an Artery that has its Direction towards the Sternum; it is the epigaſtric, with its Vein: Theſe Veſſels paſs behind the ſpermatic Nerve, that meets them near their Origin to go towards the interior Side of the Muſcle juſt mentioned.

The Trunk seen posteriorly. After having raiſed the Teguments, we ſee only two large Muſcles, which, from the Occiput to the Os Innominatum, or Pelvis, cover on each Side all the Back, and alſo all the poſterior Part of the Neck that we ſhall mention in this Article: The ſuperior is called Trapezius, and the inferior Latiſſimus Dorſi. The firſt occupies all the Neck, a Part of the Omoplata and the Clavicula, and extends itſelf to the laſt ſpinal Vertebra; the ſecond covers

all that Part from the Omoplata; viz. the inferior and lateral Part of the Spine quite to the Os Sacrum and Os Ilei. After the Trapezius, between the Baſis of the Omoplata and ſpinal Apophyſes of the Vertebræ, we diſcover the Rhomboïdes; and, behind this laſt Muſcle, the ſuperior and inferior Serratus Minor.

After having raiſed all thoſe Muſcles of the ſpinal Apophyſis, and having put them back; we diſcover, 1. The Elevator Scapula ſituated upon the lateral Part of the Neck, terminating in the ſuperior Angle of that Bone. 2. The Splenius, extending itſelf from the Apophyſis of the Spine of the ſuperior Vertebra of the Back to the Os Occipitis; this laſt being raiſed, we diſcover the Complexus, which has almoſt the ſame Extent, tho' in a contrary Direction.

The ſuperior Part of the Complexus hides four ſmall Muſcles, ſituated between the ſpinal Apophyſis of the ſecond Vertebra and the Os Occipitis. The moſt conſiderable are, the Obliquus Superior and Inferior; the others are, the Rectus Major and Minor Poſterior: Then there remains only, upon the Back, the three Extenſores Majores, ranged, in a parallel Order, Side by Side. The moſt external is the Coſta Cervicalis, extending from the Pelvis to the tranſverſe Apophyſes of the cervical Vertebræ. The next that follows is the Longiſſimus: It has almoſt the ſame Origin, and aſcends to the Os Occipitis. The third is the Obliquus Spinalis: It touches all the ſpinal Apophyſes of the lumbal Vertebræ and the Spine, to the ſecond cervical Vertebra. We diſcover, in raiſing the Complexus, a pretty conſiderable Nerve that penetrates thro' it; it is a Branch of the firſt cervical Pair. We eaſily diſcover the Trunk of that Nerve, if we deſtroy the Obliquus Inferior, and afterwards ſeparate from the Os Occipitis the Ob-

Obliquus Superior; then will be ſeen, without any other Preparation, behind this Muſcle, the Trunk of the Infra Occipitalis Nerve, and a Portion of the vertebral Artery.

4. The Thorax. The anterior Side of it being deprived of the Pectoralis Major and Minor, Latiſſimus Dorſi, Obliquus Major, and the Rectus Muſcles; we then free the Sternum and Ribs, with their cartilaginous Portion, and the intercoſtal Muſcles, which occupy, very exactly, all the Space between the Ribs.

We have ſaid, that we could ſee, without any Preparation, the two Planes of intercoſtal Fibres; that the external Plane terminated at one or two Inches from the Cartilage that makes the Complement of the Ribs: Therefore one may obſerve a very conſiderable Portion of the internal Plane, which is eaſily diſtinguiſhed from the other by the Direction of its Fibres.

After having cut the Ribs as already taught, the Sternum is kept in its Place; then is ſeen, on both Sides, the Lungs (which fill very exactly that double Space) incloſed in the Cavity of the Thorax: It is carried inferiorly upon the tranſverſe muſculous Margin named the Diaphragm. If we raiſe the Sternum, in its internal Surface are ſeen, 1. The interior mammillary Veſſels that run under the cartilaginous Extremity of the Ribs. 2. The Sterno-coſta Muſcles, which are, however, not well perceived till we pull the Sternum back. 3. The Margin that ſeparates the Cavity of the Thorax in two, called the Mediaſtæum. This Margin, which is pretty regular vertically ſuperior, loſes that Direction in its inferior Part, where the two Membranes that compoſe it widen themſelves, to leave a ſuitable Space for the Heart and its Pericardium.

After having taken away the Sternum, in keeping the Mediaſtinum as ſound as poſſible, one may perceive, by pulling a little aſide the Lobes of the Lungs, 1. The diaphragmatic Nerve and Vein, which run all along the Mediaſtinum and Pericardium. 2. The mediaſtic and pericardic Veins, that equally appear without any Preparation. It muſt be obſerved, that we only meet the diaphragmatic Vein on the left Side; it is the ſuperior we mean.

The Membrane that covers the Nerve and Veſſels we have juſt mentioned; and that which ſeems to form the Mediaſtæum, belongs to the Pleura. It is obſerved, after having removed it, that the Capſula ſurrounds the Heart by the Name of Pericardium. It has more Solidity than the Pleura; and, in opening it, we perceive the Heart in all its Extent, with the Principle or Origin of the great Veſſels: That Organ is ſituated obliquely upon the aponeurotic Part of the Diaphragm that ſeems to be confounded here with the Pericardium.

The Baſis of the Heart gives Origin to two great Arteries, known by their Solidity and Whiteneſs. The right one is the Aorta; the left the pulmonary Artery. On the right of the Aorta we ſee the Vena Cava, and the anterior Auricle of the Heart. If we turn up this Organ, we ſee the poſterior Auricle of the pulmonary Veins, which do not appear plain till they are well prepared.

We ſhall mention the Nerves, coronary Veſſels, and other Parts of the Heart, hereafter.

On the internal Surface of the firſt Bone of the Sternum, we find, between the Lamellæ of the Mediaſteum, a white Body void of Senſibility, except in the Fœtus; it is the Thymus; whoſe remarkable Veſſels have the Names of Artery and thymic Vein. The left ſubclavian Vein that opens

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in the ſuperior Cava is immediately ſituated behind the Thymus.

When we raiſe the left Lobe of the Lungs, and pull it back to the right, there appears a great Cavity, which is that contained by it. It is covered by the Pleura, thro' which are diſtinctly ſeen the Nerves and Veſſels we ſhall mention hereafter. If that Membrane be raiſed, we may diſtinguiſh much better all thoſe Parts; the moſt conſiderable of which are, 1. The Aorta, which runs on the Body of the Vertebræ. 2. A Portion of its winding Part. 3. The ſubclavian Artery.

There is, before the Aorta, a pretty conſiderable Nerve called Par Vagum. It forms, under the Lungs, a remarkable Winding called the pulmonary Plexus: The Nerve of the Par Vagum meets, above the Curvature of the Aorta, the diaphragmatic Nerve juſt mentioned, with which they interſect, the diaphragmatic being the anterior one; and we may eaſily follow the Nerve of the Par Vagum quite to the Diaphragm. It throws itſelf, juſt before it arrives there, upon a very conſiderable muſculous Duct, that runs, on the right of the Aorta, in the Middle of the Body of the Vertebræ, named Oeſophagus.

If we diſengage a little the Aorta below its Winding, by pulling it from the Lungs, we eaſily diſcover in the cellular Subſtance, which muſt be deſtroyed, a ſmall Artery going to that Viſcera; it is the bronchial Artery. We may prepare, with the ſame Facility, the Arteries of the Oeſophagus, which are ſmall Branches of the Aorta or the Intercoſtals that run to the Oeſophagus, one commonly meets behind the Aorta a Vein more or leſs conſiderable that belongs to the Azygos. It commonly aſcends upon the left ſubclavian Artery, to throw itſelf in the ſubclavian Vein on the ſame Side.

There appears upon the Root of all the Ribs a very conſiderable Nerve divided by ſeveral Ganglions; of which the ſuperior, ſituated upon the Root of the firſt Rib, is called the ſuperior thoracic: That Nerve which is called the intercoſtal, diminiſhes greatly towards the Diaphragm; ſometimes it is ſcarce perceptible, if we do not deſtroy the cellular Subſtance that ſurrounds it. From about the ſixth Rib to the Diaphragm it divides into three or four Branches that run on the Body of the Vertebræ: They reunite into a ſingle Cord that goes upon the Aorta to penetrate thro' the Diaphragma, and form in the Abdomen the ſemilunar Ganglion which we ſhall mention hereafter. It appears again between the Ribs of the Nerves that follow their Direction; it is the dorſal Nerves proceeding from the Medulla Spinalis: They communicate very plainly with the intercoſtal by Filaments already mentioned.

When we raiſe the Aorta, and divide it from the cellular Subſtance, we diſcover the inferior intercoſtal Arteries which paſs behind the intercoſtal Nerve to go between the Ribs in following their Direction, the ſame as the dorſal Nerves.

The intercoſtal Veins, which are eaſily traced to the Azygos, accompany them. If we put a little aſide the ſubclavian Artery in carrying it towards the ſuperior thoracic Ganglion, we eaſily diſcover the Trunk of the ſuperior intercoſtal Artery that runs upon the firſt dorſal Nerve; that of the ſuperior intercoſtal Veins is pretty remote from it; it aſcends to the intercoſtal Nerve to go to the Vena Azygos.

In the right Cavity of the Thorax we obſerve the ſame Parts, with this Difference only; that, in lieu of the Aorta, we obſerve a pretty conſiderable Vein, that runs on the Side of the Oeſophagus, named Vena Azygos. It bends near the fifth

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dorſal Vertebra to empty itſelf into the Vena Cava. The Azygos receives all the intercoſtal Veins on both Sides, when it is ſingle, its Size being then very large, and diminiſhes in Proportion to that of the Branch that has been met in the left Cavity. Upon the convex Surface of the Diaphragm is ſeen the Diviſion of the Arteries and Veins of that Part, which may eaſily be traced to their Origin.

We have mentioned, that we might diſcover, in the ſuperior Part and its Middle of the Thorax, behind the Thymus, the left ſubclavian Vein that runs to the Vena Cava, formed by the Concourſe of the two Subclavians, which will make us know the right ſubclavian Vein, it being ſhorter than the former. If we remove all thoſe Veſſels, and free a little the Aorta, we ſee its winding Part, that runs in three large Branches. The moſt anterior one is the right ſubclavian Artery, which runs immediately before the Trachea Arteria; the ſecond is the left carotid, that aſcends; the third, and deepeſt, is the left ſubclavian. The right one, at the Diſtance of an Inch, gives Birth to the right carotid, which is, at leaſt, as large as the following Trunk of the ſubclavian that goes towards the Humerus. If we follow a little this laſt, we ſoon meet with the Trunk of the Par Vagum, which Cord leaves in that Part a very obvious Nerve that embraces the ſubclavian Artery poſteriorly, to aſcend again towards the Larynx; it is called the recurrent. After having freed the winding Part of the Aorta, and met with the left Trunk of the Par Vagum, we perceive the recurrent Nerve on that Side which embraces the Aorta poſteriorly, to go towards the Larynx, the ſame as its Fellow.

The recurrent on each Side, or the Trunk of the Par Vagum, in that Part throws ſome Nerve that

that runs behind the Origin of the Aorta to form the cardiac Plexus. Relating to the intercoſtal Filaments which contribute to form the ſaid Plexus, we muſt not expect to ſee them, if we do not take them at their Origin, in diſcovering the Trunk of the Intercoſtal at the ſuperior Part of the Neck. Behind the right Subclavian we meet with the Trachea Arteria, and then its Diviſion, the Glands of the Bronchia, and many other Parts, that belong to the Lungs.

5. The Abdomen. After we have opened the Peritonæum on one Side, and turned back the Pieces, we ſee, in raiſing the Umbilicus, or Navel, that falciform Production of the Peritonæum which ſerves as a Ligament to the Liver, and the inferior Margin ſuſtains the umbilical Vein. The Peritonæum being entirely deſtroyed on both Sides, one at once obſerves ſeveral Parts, which are, 1. The Liver, placed in the ſuperior Part of the Abdomen, on the right Side. 2. The Stomach, lying almoſt all on the left Side, and that the Liver partly covers. 3. Under the Stomach a fatty Membrane that hangs looſe upon the Inteſtines, covers the greateſt Part of them, and is named Epiploon, or Omentum. We may ſee thro' that Membrane, under the Liver and Stomach, a great Inteſtine, which is ſituated tranſverſly, and ſerves, with the Stomach, as an Origin to the Epiploon; it is the middle Portion of the Colon. We alſo diſcover, without any Preparation, in pulling back the Epiploon upon the Stomach, 1. A great Part of the Jejunum, which lies almoſt entirely on the left. 2. A conſiderable Portion of the Ilium, whoſe two Thirds are lodged on the right, and is what is called the great Pelvis. 3. A Winding of the Colon, that appears on the left Side of that Cavity. 4. The Bladder, lodged in the ſmall Pelvis.

vis. We do not mention ſome Portions of the Meſentery which appear between the Sides of the Inteſtine.

In raiſing the Liver, we diſcover, 1. The Gall-Bladder. 2. The Epiploon minor, ſituated between the Stomach and that Viſcera. 3. The Lobule of SPIGELLIUS, which appears thro' the Epiploon minor. We find beſides, in that Part, 1. The biliary Veſſels, known by their Colour; the Vena Cava, known by its Greatneſs; and the hepatical Artery, diſtinguiſhed from the other Veſſels by its Solidity. 4. The Plexus Hepaticalis, which embraces this laſt, &c. All thoſe Parts appear only in their full View when we have made ſome ſuitable Preparation.

We obſerve again, in raiſing the Liver, the Pylorus, or interior Orifice of the Stomach, with the Origin of the Duodenum, which commonly touches the Gall-Bladder, the Stomach being ſeparated from the two Epiploons; and diſcover, in raiſing it, 1. The Pancreas, known by its tranſverſe Situation and Solidity. 2. The Spleen, which is faſtened to the Stomach by the left lateral Part of its Baſis. If we ſeparate the middle Part of the Colon of the epiploïc Production, which makes it adhere to the adjacent Parts, and turn it back upon the Stomach, we diſcover the Duodenum in all its Extent and the Beginning of the Jejunum, and all the Continuation of that Inteſtine, which, as we have ſaid, is placed almoſt entire in the left Cavity of the Abdomen.

In removing the Ilium, lodged particularly in the right, we ſee on that Side the Origin of the Colon, the Cæcum and its vermiformis Appendix. If we pull aſide the Jejunum, we ſee, under the Spleen, a Continuation of the Colon, which may be eaſily traced to its Curvature; from thence we go on very eaſily to the laſt of the great Inteſtines called

called Rectum, eaſily diſcovered by pulling aſide the Ilium and inferior Bendings of the Colon.

After having conſidered the Inteſtines fixed to the Meſentery, and raiſed them, we perceive, without any more a-do, 1. The principal Branches of the Meſentery. 2. The Bending of the Duodenum that runs thro' it. 3. The Pancreas in all its Extent. 4. The Ligaments of the Liver and Spleen. The other Parts are covered over by the Peritonæum, which muſt entirely be raiſed. After having done this, 1. The Aorta and Vena Cava running parallel upon the Body of the Vertebra. 2. The Vena Porta. 3. All the Branches and Ramifications of thoſe Veſſels. The Kidneys are placed by the Aorta and Vena Cava: Upon the ſuperior Part of them we perceive the atrabilary Capſules; ſometimes they are at a ſmall Diſtance. The pſoas Muſcle that belongs to the Thigh is placed by the Side of the lumbal Vertebræ; the iliac occupies the Cavity of the Oſſa Ilii; above that Bone we ſee the Quadratus.

As to the Nerves, we find thoſe of the Par Vagum upon the ſuperior Part of the Stomach: We eaſily diſcover the Origin of the intercoſtal, after it has perforated the Diaphragm, if we ſeek for it above the Origin of the Pſoas, in regard to the Plexus thoſe two Nerves form in the Abdomen, as they do not appear without Preparation.

The Ureters may eaſily be traced from the Kidneys to the poſterior Side of the Bladder near the Veſiculæ Seminales, in Men.

The ſpermatic Veſſels in Men riſe a little lower than the renal Arteries, and run under the Peritonæum, on the pſoas Muſcles, paſs the annular Aperture of the abdominal Muſcles, and are diſtributed on the Teſticles, and in Women on the Uterus. Thoſe Tubes which riſe from that Portion of the Teſticle called the Epididymis, are

are the Vaſa Differentia, which bring the ſecreted Semen into the Reſervoirs which are called Veſiculæ Seminales, which are ſituated on that poſterior Part of the Bladder which adheres to the Rectum.

As for the Penis, it requires very little Preparation after the Cutis is raiſed, and its proper Muſcles eaſily diſcovered.

For the Parts of Generation in Females; when the Cutis is removed, and the Fat deſtroyed over the Os Pubis, we diſcover the Clitoris and Nymphæ, which are continued on the Sides of the Labia of the Vagina: Immediately under the Head of the Clitoris we find the urinary Paſſage; lower down is the large Aperture called the Vagina, which is the external Paſſage of the Womb, at the Bottom of which we obſerve the Os Tincæ, or internal Orifice. When we examine the Womb as it lies in the Pelvis, we firſt obſerve the Fundus and Ovaria, which lie laterally by the Fallopian Tubes, under a Portion of the Duplicature of the Peritonæum called the large Ligaments; and another Ligament, riſing from the Fundus of the Uterus, paſſes thro' the Aperture of the abdominal Muſcles as the ſpermatic Veſſels do in Men, and terminates aponeurotically upon the Os Pubis.

6. The superior Extremity. We conſider in this Head not only all the Parts of the Arm, Cubit, and Hand, but alſo what we meet upon the Scapula; becauſe the Connection there is between that Bone and the ſuperior Extremity, hinders one from dividing them.

The Scapula seen by its exterior Surface. We meet with a large Muſcle that belongs to all its Spine, and a Part of the Clavicula; it is the Trapezius. There are two others which have their Inſertion at its Baſis: The ſuperior is the Elevator Scapulæ, which occupies the ſuperior Angle

Angle of that Bone and the fourth Part of its Baſis; the inferior is the Rhomboïdes: This laſt has its Riſe from what remains of the ſame Baſis. Behind the Trapezius, in the ſupra ſpinal Cavity, lies the Supra Spinatus; the Infra Spinatus is lodged in that Cavity below the Spine. We find after this, upon the ſame Level, the Teres Minor; under this Muſcle lies the long Head of the Brachialis Triceps, and then the Teres Major that comes from the inferior Angle of the Scapula. Upon the anterior Angle of this Bone a Portion of the Deltoïdes is ſeen, and the external Scapula in a Sciſſure of the ſuperior Rib.

The Scapula seen by its interior Surface. The Muſcles which proceed from the Baſis of that Bone are, as we have already ſaid, the Rhomboïdes and Elevator: They appear much better on that Side. The Sub-ſcapularis fills the interior Surface of the Scapula; the coracoïd Proceſs gives Riſe to two Muſcles, which are, the Coraco-Brachialis, and the long Head of the Biceps; the ſecond Head of that Muſcle comes from the Margin of the articular Cavity of the Scapula. The Veſſels we meet behind this Bone, are Branches of the interior Scapula.

The Arm seen anteriorly. We muſt conſider under the Arm, behind the Pectoralis Major and Minor, Nerves and Veſſels, which are the moſt conſiderable of the ſuperior Extremity.

The baſilic Vein, that receives the principal cutaneous Veins of the fore Arm, is the moſt conſiderable and ſuperficial; the brachial Artery runs by the Coraco-Brachialis as far as the fore Arm; the poſterior brachial Vein is not far from it, and runs in the ſame Direction. The firſt Nerve that preſents itſelf is the median, which runs anteriorly towards the Middle of the fore Arm; the cutaneous Muſcle follows it, and runs through the

coraco-brachial Muſcle: Theſe two Nerves commonly run from the ſame Origin. Next to the Baſilica is ſeen a little Nerve, which accompanies that Veſſel to the Arm; it is the Cutaneus: After this, we ſee the Cubital that runs behind the internal Condyle of the Humerus. Its two loweſt Muſcles are, the articular and radial, which commonly proceed from the ſame Cord: The firſt is the ſhorteſt, and runs behind the ſuperior Extremity of the Humerus near the Articulation; the ſecond paſſes alſo poſteriorly towards the Middle of the Humerus, and pierces in that Part the Triceps Brachialis, to go towards the lateral Part of the Arm, where it meets the ſuperior Extremity of the Supinator Longus, before which it paſſes in the anterior Part of the fore Arm.

The cephalic Vein runs on the external Part of the Arm, and goes afterwards to the Deltoïdes, to empty itſelf into the Subclavian.

The Deltoïdes is the firſt Muſcle that preſents itſelf upon the ſuperior Part of the Arm, behind its lateral internal Side; then is ſeen the Tendon of the Pectoralis Major; after this we diſcover the two Heads of the Biceps, ſituated on the anterior Part of the Arm: Behind the Tendon of the Pectoralis Major and the long Head of the Biceps, which is the moſt interior, is ſeen the Coraco-Brachialis, whoſe Origin is confounded with that of this Head: Behind the inferior middle Part of the Biceps we find a Muſcle that embraces the Humerus; it is the Brachialis: By the Side of this Muſcle, exteriorly, is met with a conſiderable Portion of the Supinator Longus.

The Arm seen posteriorly. We firſt find a Muſcle with three Heads, named Triceps Brachialis; the long Head hides the Tendon of the Teres Major: By the Side of the ſame Head is ſeen a Portion of the Deltoïdes.

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The fore Arm seen anteriorly. If we give the Hand the Situation it ought to have in Supination, we ſee, in the lateral exterior Part, the Supinator Longus; towards the internal Side we find, upon the ſuperior Part of the Radius, a Muſcle that embraces it; it is the Supinator Brevis: Under it is ſituated the Pronator Teres. It ſurrounds equally the Radius, tho' in a contrary Senſe. Its ſuperior Head is at the internal Condyle of the Humerus. Between theſe two laſt Muſcles is found the Tendon of the Biceps and Brachialis: The aponeurotic Tendon of the former throws itſelf upon the Pronator Teres and the other Muſcles that are upon the ſame Level; then comes the Radialis Internus, and afterwards the Palmaris Longus; next to which comes the Cubitalis Internus; all ariſing from the internal Condyle of the Humerus.

Behind the Palmaris Longus and Radialis Internus we find the Perforatus, whoſe Tendon paſſes under the tranſverſe Ligament; behind this we diſcover the Perforans, and next to that the Flexor Pollicis: Behind all theſe Tendons, and above the Wriſt, is ſituated the Pronator Quadratus, immediately upon the Extremity of the two Bones of the fore Arm.

The median Nerve runs between the Perforatus and Perforans, the Radialis before the anterior Margin of the Supinator Longus, the cubital Nerve all along the anterior Border of the internal cubital Muſcle, the ulnaris Artery is ſituated anteriorly along the Margin of the perforans Muſcle.

Behind the Flexor Pollicis we obſerve the Interoſſea, with a Ramification of the median Nerve that accompanies it: Upon the Tendon of the Brachialis is ſeen the Profundus.

The fore Arm seen posteriorly. In beginning towards the Cubitus, we conſider, upon the

the ſuperior Part of that Bone, a little Muſcle called the Anconæus; afterwards the cubital Externus; then the Extenſor Communis and Indicator, that runs upon the ſame Level with this laſt.

Under the Indicator is met the Extenſor Minor Pollicis, and after this we ſee the Major of the ſame; afterwards the Radii Externi, and, in fine, the poſterior Surface of the Supinator Longus.

The Hand seen anteriorly. The Aponeuroſis Palmaris, the ſmall Muſcle of the ſame Name, and the tranſverſal Ligament, are the Parts that appear firſt. After having deſtroyed them, and the ligamentous Capſula that ſurrounds the Tendons of the Flexors, we ſee the Tendon of the Perforatus, whoſe Extremity is bifurcated, to let thoſe of the Perforans paſs. In raiſing the Tendons of the Perforans, we obſerve the Lumbricales. The Metacarpus is ſituated by the Palmaris Brevis, conſidered alſo towards the Thumb, the Tendon of its Flexor. We ſhall not mention the Laterales, their Situation being very viſible. We obſerve before theſe Muſcles an arterial Segment; it is the palmary Arch.

The Hand seen posteriorly. Upon the Carpus is ſeen annular Ligaments, four in Number. The firſt receives the Tendon of the external Cubitus; the ſecond thoſe of the Extenſor Communis and of the Indicator; the third that of the Extenſor Brevis Pollicis, and the fourth thoſe of the Radius. There appear beſides, upon the Back of the Hand, many of the lateral Muſcles and ſome Veſſels.

7. The inferior Extremity. All the Muſcles belonging to the Femur ought to be comprehended in this Article; therefore we ſhall mention ſeveral which are in the Abdomen, the large and

ſmall Pelvis, and upon the Parts of the Bones that form thoſe Cavities.

The Thigh seen anteriorly. The Teguments being raiſed, we diſcover, 1. Under the Groin, the inguinal Glands. 2. All along the interior Side of the Thigh a very conſiderable Vein named Saphæna Major. 3. Towards the genital Parts, the external Vein of the Groin, and the Artery of the ſame Name; Veſſels which require ſome Preparation. All the Thigh ſeems then to be covered with an aponeurotic Membrane, which is thicker anteriorly; it is named Faſcia Lata. After it is deſtroyed, and the Fat that is under the Groin taken away, we perceive the crural Veſſels; but ought to obſerve, that about the inguinal Ligament the Artery is the moſt anterior, and more external. Theſe two Veſſels march between the Pſoas and Pectinæus, in covering a Portion of both of them. The crural Veſſels being arrived near the middle Part of the Thigh, paſs under the Sartorius that hides them: Next to the crural Artery, towards the Os Pubis, and under the inguinal Ligament, we meet with a conſiderable Nerve, that run between the Pſoas and Iliac; it is the crural: It divides in entering into the Thigh; and it is very eaſy to follow its Branches.

The firſt Muſcle that preſents itſelf after theſe Veſſels in the anterior Part of the Thigh, is the Gracilis, running towards the external Part, we meet with the firſt Portion of the Triceps, which has its Head by that of the preceding one: Then comes the Pectinæus, which is partly covered by the crural Veſſels that appear after this laſt, the Extremity of the Pſoas, which is almoſt covered by the crural Nerves and Veſſels. Its Body is placed in the Abdomen upon the lumbal Vertebra and Oſſa Pelvis. Then comes the Ilium, whoſe Body,

Body, ſituated in the great Cavity of the Pelvis, occupies the ſame; after this comes a very long Muſcle, which, from the exterior Part of the Thigh going obliquely towards the interior Part, terminate in the Leg; it is the Sartorius. Behind its ſuperior Origin we find the Tendon of the Rectus, whoſe Body occupies the moſt anterior Part of the Thigh; the Spinatus, which terminates at the Faſcia Lata, touches the ſuperior Extremity of the Rectus, its ſuperior Origin meeting that of the Sartorius. Behind the Muſcles already named we meet with many more. 1. The ſecond Portion of the Triceps Femoris, that lies directly after the firſt and ſuperior Part of the Gracilis. 2. The third Portion of the Triceps, whoſe inferior Part only is ſeen under the former. 3. The Obturator Externus, which we muſt look for before the Foramen, and behind the middle Portion of the Triceps, between that and the Pectinæus. 4. The Vaſti Internus and Externus, and the crural which embraces all three, and the Bone of the Thigh as far as the Leg. The Rectus is intermixed with theſe three Muſcles, all theſe forming a ſingle Membrane which covers the Patella. The crural is directly behind the Rectus, and is confounded with the Muſculi Vaſti; but they are eaſily diſtinguiſhed, by the Direction of their Fibres.

The Thigh seen posteriorly. We ſhall comprehend all that is from the external Margin of the Oſſa Ilei to the Articulation of the Femur with the Tibia. The moſt conſiderable one is the Glutæus Maximus, which covers the greateſt Part of the Glutæus Medius, Glutæus Minimus, &c. this Muſcle alſo covers the Trochanter Major, and extends itſelf to the third ſuperior Part of the Os Femoris. After having divided it from the Oſſa Pelvis, and turned it back, we ſee, in its interior

Surface, the glutæus Artery and Vein: The Glutæus Medius, which follows the Major, the moſt ſuperior of them, terminates at the Trochanter Major. We perceive, after having raiſed them, many Muſcles diſpoſed like a Web, which terminate about the Trochanter Major.

The firſt, in beginning by the lateral (exterior) Part, is Glutæus Minimus; then follows the Pyramidalis, that comes out of the Pelvis by the iſchiatic Opening; after this is ſeen the Cannularis, which is hollow, to give a Paſſage to the Tendon of the Obturator Internus, whoſe Body is ſituated in the ſmall Cavity of the Pelvis behind the Foramen Ovale: The laſt, which is near the Tuberoſity of the Iſchium, is the Quadratus, which is ſeen under the Pyramidalis upon the Cannularis, a conſiderable Cord called the great ſciatic Nerve; the Veſſels that accompany it are the Artery and ſciatic Vein: We alſo obſerve, relating to the interior Obturator, that it comes out of the ſmall Cavity between the iſchio-ſacra Ligaments.

All the Parts we have examined have a relative Uſe to the Thigh; but, by their Situation, it ſeems as if they did not belong to it: Theſe are thoſe which enter its Structure.

Beginning interiorly, we meet, 1. The Gracilis, a Muſcle already obſerved in the Thigh ſeen anteriorly. 2. The Sartorius, whoſe inferior Portion only is ſeen. 3. A Portion of the Vaſtus Internus. 4. All the poſterior Portion of the Triceps that extends from the Tuberoſity of the Iſchium to the internal Condyle of the Femur.

There are, beſides, three Muſcles, that ariſe from the ſame Tuberoſity, called, 1. The Semi-nervoſus. 2. The long Head of the Biceps. 3. The Semi-membranoſus. If we conſider them in the inferior and middle Part of the Thigh, they have another Order. The Semi-membranoſus is

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the moft interior; the Semi-nervofus follows, and the Biceps is the moft external: The fhort Head of this laft terminates a little above the middle Part of the Os Femoris.

The crural Vein and Artery go, as we have faid, towards the pofterior Part of the Thigh, and appear under the Articulation of the Knee, where they are called Poplitæ. They meet in that Part the fciatic Nerve which accompanies their Divifions.

The Leg seen anteriorly. In the internal Part we difcover the Saphæna Major, which runs upon the Back of the Foot towards the Great Toe; and fee, befides, a Part of the pofterior Mufcles; which are, the Gemini, Solæus, Profundus, and Tibialis Pofticus: They appear in that Order in defcending towards the Malleolus. Upon the exterior lateral Part of the Tibia, the Tibialis Pofticus, whofe Tendon croffes the Leg, and goes towards the internal Part of the Back of the Foot.

The tibial Artery runs behind this Mufcle, between its Body and that of the Extenfor of the Pollicis; we alfo obferve behind the Tibialis Anterior the Extenfor Pollicis, which has almoft the fame Direction; then is feen the Extenfor Communis for the four fmall Toes, a fifth Tendon that appears upon the Back, and terminates on the laft Bone of the Metatarfus, belongs to the anterior Peronæus, whofe Body is commonly mixed with the Extenfor Communis. Thofe four Mufcles are all fituated in the anterior Part of the Leg between the Tibia and Perinæus. There appear, befides thefe, upon the lateral Part of the Perinæus called the Peronæus Longus and Brevis, their Tendons, which pafs behind the external Malleolus.

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The Foot seen in the same Situation. We obſerve, upon its Back, the Tendons of the Tibialis Anticus, Flexor Pollicis, and thoſe of the Extenſor Communis, being four in Number; and afterwards that of the Peronæus Anterior: The Pedialis is ſituated upon the Back of the Foot, under the five laſt Tendons. We muſt conſider between the two Malleolæ Aponeurotica Annularia to give a Paſſage to the Tendons. They are three in Number: The firſt for the Tibialis Anticus, the ſecond for the Extenſor Pollicis, the third for the Extenſor Communis, and the Peronæus Anterior.

The Leg seen posteriorly. There appears at firſt ſome cutaneous Veſſels, which are Branches of the Saphæna Minor. The Muſcles are, 1. The Gemini, which form the Calf of the Leg. 2. The Solæus, ſituated behind the former. From all theſe Muſcles proceeds a very ſtrong Tendon called Tendo Achillis, which terminates at the Heel; behind the ſuperior Extremity of the Origin of the Gemini we diſcover the Plantaris: Its thin Tendon goes towards the internal Part of the Leg, to accompany that of the Achillis to the Heel.

After theſe Muſcles are ſeen, in the internal Part, the Flexor Brevis, or Perforatus, whoſe Tendon paſſes behind the internal Malleolus which goes towards the Foot; the Tibialis Poſticus that runs equally behind the Malleolus; the Flexor Pollicis, which runs, with the preceding ones, behind the internal Malleolus, but near the Heel; then the Peronæus Longus and Brevis Poſticus: We meet behind the Solæus a conſiderable Artery, with its Vein and Nerve, which goes behind the internal Malleolus, running between the Tendon of the Flexor Brevis and Flexor Pollicis; it is the Tibialis Poſticus: It is alſo to be obſerved behind the

the Body of the ſame Muſcle. Between it and the Peronæus an Artery deſcends to the internal Malleolus; it is the Peronæa.

The Sole of the Foot. Firſt we obſerve an Aponeuroſis: Having divided it, we diſcover the Perforans, whoſe four Tendons run thro' thoſe of the Perforatus; theſe are directly ſituated behind thoſe of the former. In raiſing them we find the Muſculus Acceſſor and Quatuor Lumbrici. The other Muſcles of the Sole of the Foot belong to the Laterals; their Situation will make them obſervable.

We alſo meet here, near the Root of the Finger, an arterial Segment, the ſame as in the Hand, which is the Arcada Plantaris. It is not always well formed.

*** This Essay is taken from Dr. Lieutaud's *Eſſais Anatomiques*, with ſome Improvement.

A
COURSE
OF
Anatomical Lectures.

LECTURE I.
ANTHROPOSOPHY.

THE human Body, as well as thoſe of other Animals, is compoſed of Solids and Fluids.

We underſtand by a Solid, any extended and reſiſting Object of our Senſes, whoſe Parts have more or leſs attractive and coheſive Force one to another. If this Coheſion betwixt the Parts is ſufficiently ſtrong, to keep them in their Situation, (contrary to the Force by which they tend to the Earth's Center) and preſerve the natural Figure of the Body, we call it a Solid; but if it be ſo weak, that the Gravitation of Parts brings them to a Level, or to a Portion of the Earth's Convexity, when left to themſelves, we

name it a Fluid. When the Coheſion of Parts is neither ſufficiently ſtrong to retain the Figure, nor weak enough to let them flow to a Level, we term it a ſoft Body, in various Degrees, till we come to the Coheſion of a Solid, which we call Hardneſs. Hence we ſee, that, by leſſening the Coheſion and Contact of Parts, the ſame Body may be either ſolid, ſoft, or fluid; as for Example, the White of an Egg, by different Degrees of Heat, leſſens the Attraction of Coheſion in the conſtituent Particles.

The primitive Anatomiſts, who made a general Diviſion of the Parts of the Body, merely from the outward Appearance of their Structure, called ſome Similar or Simple, and others Organical or Compound. But the Moderns uſually reduce all the Solids under certain general Claſſes, expreſſed by the Names of Fibre, Bone, Cartilage, Ligament, Membrane, Veſſel, Artery, Vein, Nerve, Muſcle, Gland, Fat, Viſcus, and Organ.

All theſe ariſe firſt from Filaments, which are generated in a mucilaginous Matter, compoſed of Spirit, Water, Oil, Salt, and Earth. This glutinous Subſtance incorporated together, forms the whole animal Oeconomy.

The ſimilar or ſimple Parts of the Animal, properly ſpeaking, are only ſingle Fibres, as they conſtitute all the reſt of the Body.

A Fibre is the moſt ſimple Filament that can be divided from the Subſtance of any Animal, and ſo minute as hardly to be perceived by the naked Eye, but when reviewed through a Microſcope, it appears ſtill to be compoſed of others.

The Figure of a Fibre is cylindrical, and its Direction either rectilineal, oblique, longitudinal, tranſverſe, circular, ſpiral, large, ſmall, or ſhort. And the more conſtant or permanent Parts thereof are Earth.

Theſe

Thefe terreftrial Particles have not their Connection and Power of Cohefion from a mere Contact, but from the intermediate glutinous Matter diffufed betwixt them *.

The terreftrial Particles cohere longitudinally by the intervening Glue, from the firft moft fimple Fibres: [as the beft Microfcopes cannot affift us to infpect thofe minute moving and nervous Fibrils, therefore how can we have an Idea of their Mechanifm, by which Senfation is effected? Or how Motion is modulated to produce the animal Senfation, or animal Senfe and Will can produce Motion, we can only conjecture?] Thefe Fibres are divided into two Sorts; the firft we have already defcribed.

The fecond Kind are thofe which connect in Breadth, from what is called cellular Subftance, which is partly compofed of the fimple Fibrils, with an Infinity of Lamelles, which, connected in various Directions, intercept the fmall Cells, and web-like Spaces; extending to every Part of the Animal, even to the leaft moving Solid, in collecting them in fuch a manner, as not only to fuftain, but alfo to allow them a full and free Motion. But, however, we obferve this cellular Membrane differ vaftly in various Parts of the Animal, in refpect to the Proportion betwixt the membranous Sides and intercepted Cells, as in the Breadth and Strength of thofe Sides, and the Nature of their contained Fluids, which is fometimes more aqueous, and at other times more oleaginous.

* This glutinous Matter is compofed of Oil, combined with Water, by which the vital Attraction in Animals, as appears from the chymical Analyfis of the Bones diffolved into a Jelly.

This cellular Subſtance in its ultimate or fineſt State, being ſtill compoſed of ſimple Membranes, when compacted and convoluted, gives Birth to the moſt minute Veſſels, which, again reflected through the Laminæ of the ſame Subſtance compacted together, form compound and vaſcular Membranes, &c

From the cellular Subſtance being compacted by a Concretion of the membranous Lamellæ, and preſſed together by the Force of the incumbent Muſcles and diſtending Fluids, ariſe other broad and flat Laminæ in various Parts of the Body; which, being generally diſpoſed in one and the ſame Direction, and theſe being convoluted into Cones and Cylinders, pervade by ſome Fluids brought to them, take the Name of Veſſels, or elſe being extended round ſome Space, that is in a Place parallel to itſelf, we call it a Tunic or Coat. But that Tunics are formed from the cellular Subſtances, is proved by ocular Inſpection, eſpecially in the Aorta or Dura Mater by Maceration; and the Tunics of the Muſcles are evidently of a cellular Subſtance, while they reſemble the Texture of other Membranes from a Degeneration of the Pericardium, as a true Membrane into the cellular Subſtance, or Membranes of the Aorta and Pulmonary Arteries; from the Origin of the hard and thick Membranes which are formed about encyſted Tumours, and which is only in the cellular Subſtance. In ſhort, how eaſy the Dartos of the Teſticles and the nervous Tunic of the Inteſtines are changed by Inflation into cellular Subſtance, or by impelling Air into the Aorta of a Fœtus, as I have ſometimes inflated the whole Body, even into the Cavities of the Bones; that it is evident thoſe filamentary Fibres are firſt formed by a transfuſed Glue, and likewiſe the membranous Fibres of the cellular Subſtance

ftance has the fame Origin, as appears from thofe cellular Fibres produced in the Thorax from a concreted Vapour or Serum, transfufed through the Surface of the inflamed Lungs, which are thereby connected to the Pleura; for thefe perfectly refemble the true and cellular Subftance. The fame appears alfo in comparifon of a Fœtus with an Adult, as the fubcutaneous cellular Subftance of a Fœtus. This we are convinced of by the fibrous Collection we extract from the Blood when coming from any Animal, by ftirring it round with a Probe while warm. Likewife we find that the bony Fibres are but a mere coagulated Glue, as in fome Difeafes they become foft as a Cartilage, and are by Art diffolved into its primogenial State by Papin's Digeftor.

Hence it is evident that the animal Solids begin, when in a gelatinous State not unlike the White of an Egg, by a fmall Portion of fine cretaceous Earth to run together into a Thread by Compreffion. Such a Filament, by the mutual Attraction of Cohefion intercepting Spaces betwixt itfelf and others, helps to form a Part of the cellular Subftance, after having acquired fome Confiftency from the adjacent terreftrial Particles, which remain after an Expulfion of the redundant aqueous Glue.

And in this cellular Subftance, whenever a greater Preffure is impofed on the Lamellæ, they degenerate into Fibres, Membranes, Tunics, and laftly into Bones; then they concrete with an unorganized Glue. Hence all the Parts of the Animal, from the fofteft to the hardeft, feem to differ no otherwife than that fome have more of the terreftrial Particles clofely compacted together, with lefs of the aqueous Glue; and others have lefs Earth.

Therefore the human Body is formed of Clay, or flimy Earth, as all the Solids, and even the globular Fluids which circulate, are generated of chalky Particles, as we fee in calcining a Lump of Blood, or a Bone, after the Air, Water, Salt, and Oil, which make the glutinous Subftance, are expelled or confumed, there remains a white, friable, chalky Earth, fimilar to the elementary ones.

We may therefore very well admire the wonderful Acts of Nature, in her wife Oeconomy and Simplicity, in forming all the Variety of the animal Fabric from a mere fimple Earth and Glue; whence the Animal is not only increafed from its firft Rudiments in the Ovum to its full Growth, but repaired every Moment during Life, till perhaps at length not two Jots of the primitive Materials remain.

This Renovation of Parts is made flower in fome Organs and Conftitutions than in others. As for Example, how quickly the Hair, Nails, &c. are renewed; which has occafioned fome Authors to conjecture, that once in three Years the human Subftances may be univerfally changed, though a Perfon remains the fame identically, yet he has not the fame Materials; if it was fo, I think we fhould never grow old.

By a MEMBRANE we underftand a pliable Texture of Fibres, difpofed or interwoven together in the fame Laminæ. They differ in Thicknefs according to the Smallnefs of the Filaments, and Number of their Lamellæ.

Thefe Lamellæ are diftinguifhed by External, Internal, and Middle

The difference of Membranes in general depends on that of the Fibres, of which they are compofed; fmall Portions of Membranes, efpecially when they are very thin, are called Pelliculæ,

culæ, and ſome membranous Laminæ are united together by the Intervention of a particular Subſtance compoſed of this Sort of Pellicles, and called the Cellular or Spongy Subſtance.

VESSELS are Tubes, Ducts, or Canals, more or leſs flexible, compoſed of different Membranes, the Strata of which are generally termed Tunics or Coats. Some of them are divided into Branches, and theſe again into Rami and Ramifications, which gradually diminiſh, but ſtill remain concave.

The general Deſign of the Veſſels is to contain Fluids; from the Diverſity of which they are diſtinguiſhed by Sanguiferous, Lacteal, and Lymphatic; the Extremities of thoſe which do not admit the red globous Particles, are generally termed Capillaries, or Lymphatics.

The ſanguiferous Veſſels are of two Kinds; one of which receives the Blood from the Heart, and diſtributes it to all the Parts of the Body, which are named Arteries; the other returns the Blood from all the Parts to the Heart, which is called Veins, and ſome of theſe have the Name of Sinuſes.

The ARTERIES are thicker than the Veins, by which they may be diſtinguiſhed in dead Bodies; and in living Subjects, by a certain Beating called the Pulſe. The Veins of the Extremities are furniſhed with Valves, that is, with ſmall membranous Sacculi, fixed at different Diſtances in their internal Cavities. The Opening of theſe Valves is broad, and turned toward that Side where the Vein is largeſt, but their Bottoms are turned to the contrary Side, where the Veins are of the ſmalleſt Diameter; in ſome Places theſe Valves are ſingle, in others double, triple, &c.

NERVES are Fafciculi of white cylindrical Fibres which proceed from the Cerebrum, Cerebellum, Medulla Oblongata, and Spinalis, and are diftributed to all the Parts of the Body, by filamentary Ramifications for Senfation; each nervous Filament may be looked upon as membranous Veffels; the Cavity of which is filled by a great Number of membranous longitudinal Septa and medullary Filaments which lie betwixt them.

MUSCLES are Collections of Fibres, called by Anatomifts Fibræ Motrices, of a reddifh Colour, and different Lengths.

The middle Portion of the moving Fibres is the principal, and differs from the Extremities, it being red, thick, foft, and capable of Contraction; whereas the Extremities are white, fmall, compact, and incapable of yielding.

This middle Portion of each moving Fibre form what is properly called Flefh, the Extremities are called Tendons.

GLANDS are Clufters or Moleculæ, diftinguifhable from all the other Parts of the Body, by their Form, Confiftence, Texture, and Connection. They are in general compofed of Arteries, Veins, Nerves, and excretory Ducts united together in their different Folds, and Intertextures, all invefted in a Membrane.

The Office of Glands is to feparate from the Mafs of Blood, by means of certain fecretory Veffels, Fluids, which they difcharge either immediately, or by other Veffels termed Excretory; and thefe Fluids are either accumulated in particular Refervoirs, or expelled out of the Body.

FAT is of an oleaginous, white, or yellowifh Subftance, of different Confiftencies, collected in cellulous Membranes.

MARROW

MARROW is a Kind of Fat, and differs from it only in the Finenefs of the oleaginous Subftance, and in its Situation within the Bones. The Word Marrow is fynonymous with Fat.

By VISCERA, we commonly underftand Parts contained in a great Cavity, without being connected to it, through their whole Extent or Circumference, fuch are the Stomach, Inteftines, &c. in the Abdomen, and the Heart, Lungs, &c. in the Thorax.

ORGANS are Terms given to every Part capable of any Function, whether it be fimple or complex; and in this Senfe we call the Organ of Sight, of Refpiration, &c.

A LIGAMENT is of a white, fibrous, compact Subftance, yet flexible and elaftic.

A CARTILAGE is a hard elaftic Subftance.

BONES are the moft compact Fibres of the Body; therefore the hardeft Subftance which forms the Bafis of the whole animal Fabric, the Knowledge thereof is the fundamental Part of the animal Oeconomy, and without which it is impoffible to have a perfect Idea of the Mechanifm of the human Frame *. We fhall therefore begin with them.

The Fluids contained in Solids, are the Blood, Serum, Lympha, &c. from thefe all the other Liquors are fecreted.

All the Parts of the Animal exift in Miniature, from the firft Moment the Uterus is impregnated, and afterwards gradually increafe by the Extenfion of its Parts.

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* CICERO obferves, "Quid dicam de offibus, que fubjecta corpora "mirabiles commiffuras habent, & ad habilitatem aptas, & ad artas "firmandes accommodates, & ad motum, & omnem corporis ac-"tionem." Lib. II. de Nat. Deorum.

A

A Skeleton is an Aſſemblage of all the Bones of any Animal, either connected with their natural Ligaments or artificially.

Anatomiſts uſually apply Oſteology, as a Diſſertation, as well as Deſcription of the Bones, but I ſhall divide it into three Heads, viz.

1. Osteogeny.
2. Synosteography.
3. Osteography.

As we cannot avoid mentioning ſeveral Parts of the Bones, it will be therefore more methodical, before we enter into the particular Examination of them to give a preliminary Idea of the whole Skeleton, by enumerating the ſingle Pieces which it is compoſed of.

The Skeleton is divided into Head, Trunk, and Extremities.

The Head is divided into two Parts. The firſt is a bony Cavity called Cranium or Skull; the other conſiſts of ſeveral Pieces, which form the greateſt part of the Face, though ſome Part of the Cranium contributes thereto.

The Cranium conſiſts of eight Bones, viz. the Os Frontis, the Forehead Bone; Os Occipitis, the Occipital Bone; Oſſa Parietalia, the Sinciepital or Parietal Bones; Oſſa Temporum, the Temporal Bones; which contain four little ones, viz. 1. Incus, or Anvil; 2. Melleus, or Hammer; 3. Strapes or Stirrup; 4. Orbicular or Lenticular; Os Sphenoïdes; the Sphenoïdal Bone; and Os Ethmoïdes or Cribroſum, the Ethmoïdal Bone.

Beſides theſe, we often meet with ſupernumary Bones, the Size and Number of which vary conſiderably.

The ſuperior Maxilla, or Jaw, formed of two large Bones, called Oſſa Maxillaria, from the Word

Word Maxilla, by which this Part of the Face is expreffed; the two Offa Unguis or Lachrymalia; the two Offa Nafi; the Offa Palati; the two Offa Convoluta, or lower Shells of the Nofe; and one Bone named Vomer. All thefe amount to thirteen, without reckoning the Teeth, which are commonly fixteen.

The inferior Maxilla, or lower Jaw, has but one Bone in Adults, and two in Children, and as many Teeth as the Superior.

The Trunk is divided into three Parts; one commonly called the Spine; and two proper, viz. the Thorax or Breaft, and the Pelvis.

The Spine is compofed of twenty four Bones called Vertebræ, feven of which belong to the Neck, twelve to the Back, and five to the Loins; and a Bone, termed Os Sacrum, with its Appendix, named Os Coccygis or Coccyx.

The Thorax is chiefly formed by means of the Ribs and the Sternum. There are on each Side twelve Ribs, fixed by their pofterior Ends to the Vertebræ of the Back, by their anterior to the Sternum. The fuperior feven are called the true Ribs, and the five inferior falfe Ribs.

The Sternum, or breaft Bone, confifts of two or three Pieces, lying between the anterior Ends of the true Ribs.

The Pelvis is chiefly formed by two great Bones, called Offa Innominata, fubdivided, viz. Os Ilium, Os Ifchium, and Os Pubis, joined before to each other, and behind to the Os Sacrum, which completes the Pelvis.

The Extremities of a Skeleton are four; two fuperior, which are on each Side of the Thorax; and two inferior, joined to the Sides of the Pelvis.

Each fuperior Extremity is divided into the Shoulder, Arm, Fore-arm, and Hand.

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The Shoulder is compoſed of two Pieces; one before called Clavicula, or Collar Bone and one behind, Scapula, or Blade-bone. The Arm is only one Bone, termed Os Humeri, or Arm-bone. The Fore-arm has two, the Ulna and Radius. The Hand is divided into three Parts; the Carpus or Wriſt, conſiſting of eight Bones. 1. Os Scaphoïdes; 2. Os Lunare; 3. Os Cuneiforme, 4. Piſiforme; Os Trapezium; 6. Os Trapezoïdes; 7. Os Magnum; 8. Os Unciforme. The Metacarpus, which is made up of four Bones and five Fingers, each of which contains three Bones called Phalanges.

Each inferior Extremity is divided into the Thigh, Leg, and Foot.

The Thigh has but one Bone, termed Femur, or Os Femoris.

The Leg is made up of two large Bones, named Tibia, or Shin, and Fibula, or ſide Bone, and of one ſmall Bone called Patella or Knee-pan.

The Foot is divided into three Parts; the Tarſus, or Inſtep, which is compoſed of the ſeven following Bones, viz. the Os Calcis, Aſtragalus, Os Naviculare, Os Cuboïdes or Quadratum, and all the three Oſſa Cuneiformia; the Metatarſus is formed of five Bones; and the Toes, which are five, the greateſt conſiſting of five Bones each, called Phalanges, as thoſe of the Fingers.

There are, beſides theſe, ſome ſmall Bones, which are rarely preſerved in a Skeleton, viz. the Os Hyoïdes, or Bone of the Tongue, the eight Oſſicula Audita, or Bones of the Ear, four lying in each temporal Bone. The little Bones ſometimes found at the Extremities of the Apophyſes Peſtroſæ, towards the Sella Turica; and the Seſamoïdal Bones of the Fingers and Toes.

We

We ſhall not here mention, a Kind of Seſamoïdal Bones, ſometimes found on the Condyles of the Femur, at the lower End of the Fibula, at the Os Calcis and Os Cuboïdes.

After this Enumeration of the Bones of the Skeleton, we may eaſily determine their Number; to the Head, belong fifty four, without reckoning either the Os Hyoïdes or the Oſſicula Audita; to the Trunk, fifty four, taking the Coccyx for one Bone, and the Sternum for two; and to the Extremities, a hundred and twenty four, leaving out the Seſamoïdal Bones, ſo that the whole Number is two hundred and thirty two; to which, if we add the eight Bones of the Ear, and the five principal Pieces of the Os Hyoïdes, we ſhall have two hundred and forty five; the Seſamoïdal Bones not included.

LECTURE II.

Osteogeny, or the Nature and Generation of Bones.

THE Bones are the hardeſt and moſt compact Fibres of the Animal connected to one another by ſome ſmall tranſverſe Filaments, which are in a Fœtus very conſpicuous.

The Subſtance of the Bones is found on Examination to be a Texture of ſolid Fibres, differently diſpoſed, according to the particular Conformation of each Bone.

Theſe bony Fibres are eaſily diſtinguiſhed on the Surface of the Ribs, where they may be ſeparated much after the ſame Manner as we do thoſe of Whale-bone or Horn. We may likewiſe perceive them by the Fiſſures in Bones, which have been long expoſed to the Sun or Air, or otherwiſe dried.

Theſe Fibres in general are ſo diſpoſed, as to form in ſome Bones, Laminæ of a conſiderable Extent, and in others Filaments of different Sizes.

The general Structure of the Subſtance of the Bones conſiſts in their Diſpoſition and their Subſtance; which is partly compact or ſolid, partly cellulous or ſpongy, and partly reticular.

The

The Solidity of the Bone lies chiefly externally, and the Cellulous internally. The first is most considerable in the large cylindrical Bones; the other in those which have no remarkable Cavities.

The solid Part is formed by Laminæ in different Strata.

The Spongeous consists chiefly of Laminæ and Filaments variously interwoven. The Filaments alone, from the reticular Texture, principally observable in the long cylindrical Bones.

The external Laminæ may be observed to lie in pretty regular Strata, but more especially internally; this Disposition is gradually altered; these appearing in some Measure to lie in Gathers, or unequal Folds, are all interiorly perforated, as so many Apertures of different Sizes and Figures. In the same Manner do the Laminæ, which compose the solid Parts of Bones, change their reticular Disposition to form what is called the cellulous or spongy Substance, which forms almost the interior Texture of the Bones, and has no large Cavities. In all the Epiphyses of the convex Bones, this is found only near their Extremities.

The Cells, or void Spaces, in this spongy Part are more considerable in some Bones than in others; and the Laminæ, which compose them, differ in Form, as well as Extent, being more or less flat, crooked, twisted, angular, irregular, thick, thin, broad, narrow, &c.

In many Bones these Laminæ appear to degenerate into small Filaments, so that the cellulous Part of such Bones is, as it were, a Mixture of Lamellæ and Filaments, representing a Kind of fine Sponge. In some Bones a certain Regularity may be observed in the Disposition of them.

Besides the small Filaments found in the cellulous Part of Bones, there is a reticular Texture of them in the Cavities of several long Bones; the Fibres of which Net-work are long fine Branches, pliable, and curiously interwoven at different Distances.

This reticular Texture may be said to arise partly from the interior Sides of these Bones, partly from their Extremities from cellulous Portion. Several Ramifications are produced from it, which appear as it were suspended through the whole Length of the Cavity of the Bone, meeting and uniting together; which, however, are always at a considerable Distance from each other*.

Besides the Cavities which appear in examining the external Conformation of Bones, there are several others observable in examining their internal Structure, which may be all reduced to three Kinds, very different from one another.

The first Kind comprehends the large internal Cavities, found chiefly in the Middle of the long Bones, which are nearly of a cylindrical Figure; such as the Humerus, Ulna, Radius, Femur, Tibia, Fibula, the Bones of the Metacarpus, Metatarsus, Fingers, and Toes. In these the Cavities are proportionable to the Length and Thickness of the Bones.

The Surface of these Cavities is more smooth and even than near the Extremities, where they become more rough, unequal, and furrowed, according as the Disposition of the Laminæ happens to be changed, and osseous Productions, or cross

* This Texture is very often destroyed in taking out the Marrow of Bones that are designed for a Skeleton.

Pieces,

Pieces, may sometimes be observed in them, which are either single or combined together different Ways. The reticular Texture already described, is chiefly found in these large Cavities.

The second Kind of internal Cavities consists of Cells and Intervals in the cellulous Portion of the Bones. Some are large, small, single, double, or more compounded, and of these last some contain several small ones within them. Others are round, flat, oblong, tubular, oval, angular, square, irregular, &c. And of these the Oblong and Tubular lie in Directions nearly parallel to the Length of the Bone. Most of the Cells communicate with one another in a different Manner.

The third Sort of internal Cavities comprehends the Ducts and Pores found in the Substance of Bones. Some of these Ducts are very small, and lose themselves in the inner Substance of the Bone; the rest are larger, which having penetrated the Substance of the Bone for some space, obliquely pass quite through it afterwards.

These latter are but in small Numbers, and more seldom met with in the middle of Bones, than about their Extremities and Edges. But the former are very numerous, and lie commonly in a Direction parallel to the Length or Breadth of the Bone.

The internal Pores, though imperceptible to the naked Eye, are plainly discovered by the yellowish Matter which transudes through Bones long kept without being prepared.

All that has been said about the internal Structure of Bones may be exemplified in the Femur, by sawing it through the Middle lengthways.

For thus we discover the three different Substances very plainly, the middle Part consisting of a Tube, with thick Sides formed by the compact

or solid Substance alone; the Extremities made up chiefly of the cellulous and reticular Substances observable in the middle Cavity.

The Laminæ of the solid Part are gradually separated from one another towards the Extremities, being connected by small lateral Laminæ differently disposed in form of Cells. From this Disposition the Laminæ came to be of different Lengths; those near the Surface of the Bone reaching to the very End thereof, the rest which lie more internally, decreasing gradually in Length; thus the interior Laminæ are the shortest, the exterior the longest, and the intermediate ones of different Lengths between these two Extremities.

Therefore the solid Substance of the Femur is very thick in the Middle, but grows gradually thinner towards each End, appearing there only as a bony Crust laid over the cellulous Substance. It may likewise be observed, that the most interior Laminæ are less smooth and even than the other, lying, as has been said, in Gathers or Folds with some opening between them, and very irregular.

GAGLIARDI says Laminæ are firmly joined to each other by means of a great Number of Claviculi, or small bony Processes, which, rising from the interior Lamellæ, pierce through some, and are fixed into others of the more external Laminæ. He has described and represented four different Species of these bony Nails, viz. the perpendicular, oblique, headed, and crooked. He likewise endeavours to account for their Formation, and to shew how well they are fitted for uniting the Laminæ of Bones without any Inconvenience *.

This

* The Claviculi may possibly be true; but in Bones prepared as he directs, I could never be able to see more than numerous irregular Processes

This ſpongy cavernous internal Part of the Bones is generally called their Cancelli, or Lattice-work, and formed in the following Manner. The Laminæ are firmly joined about the Middle of the Bone; but as they are extended towards its Extremities, the more internal Laminæ ſeparate from the exterior, and ſtretch out their Fibres towards the Axis of the Bone, where they are interwoven with the Fibres of other Laminæ that have been ſent off in the ſame Way; and ſeeing the Laminæ are thus conſtantly going off in their Courſe towards the Extremities, the ſolid Sides of the Bone muſt become thinner proportionably, and the Lattice-work muſt be thicker and ſtronger. This is ſeen evidently in ſome Bones, where the ſolid Walls or Sides are no thicker than Paper, and the Cancelli are numerous, and large enough to fill up the whole Space left between the Sides.

The Twiſtings and Windings which theſe Cancelli make, and the Interſtices which they leave, differ conſiderably in Figure, Number, and Size; and therefore form little Cells, which are different, but communicate with each other *.

The Cancelli ſuſtain the membranous Veſſels of the Marrow, which are ſtretched upon them, and thereby hinder theſe membranous Parts to be torn or removed out of their proper Places, in the violent Motions, and different Poſtures which the

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Proceſſes riſing out from the Laminæ; and the accurate Diſcoverer of the minute Structure of Animals, MALPIGHIUS, thinks theſe nothing elſe than ſome few of the bony Fibres riſing perpendicularly, while the greateſt Number run horizontically, and denies them to have any ſuch regular Appearances as GAGLIARDI deſcribes.

* GAGLIARDI minutely remarks theſe different Appearances of the Cancelli, after they begin to ſeparate from the Laminæ, and from thence diſtinguiſhes them into Cancelli corrugati or wrinkled, Cribriformes or perforated and Reticulares.

Bones are employed in, or in the several Degrees of Distention which the Vessels are brought to, by the Increase or Decrease of the Quantity of Marrow. This Support which the Cancelli afford the Marrow, also saves the Membranes and Vessels of this Substance, in the inferior Parts of the Bones, from being compressed by the Weight of the Marrow in their middle and superior Parts, which would make a considerable Pressure in the long perpendicular Bones.

The Depressions between the Fibres of the exterior Laminæ of Bones appear like so many Furrows on their Surface, into each of which the Periosteum enters, by which the Surface of Contract between it and the Bone is considerably increased, and a greater Number of Vessels is sent from it into the Bone. On both these Accounts the Adhesion is stronger than it would be, if there was less Surface of Contract and fewer Vessels.

Both on the Ridges and Furrows, numerous little Orifices or Apertures are to be seen, by which the Vessels pass to and from the Bones *.

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* After a successful Injection, the Arteries can be traced in their Course, from the Apertures to the Laminæ and Fibres; and in sawing, cutting, or rasping the Bones of living Creatures, these Vessels discover themselves by the small Drops of Blood which then ouze out from the most solid Part of Bones. But the clearest Demonstration of the intimate Distribution of these small Arteries, is, to observe the Effect of such a tinging Substance as can retain its Colour, when swallowed, digested, and mixed with the Blood of any living Animal, and at the same Time has Particles small enough to be conveyed into the Vessels of the Bones, such is Tincture of Madder-Root, gradually tinging their Periosteum into the more internal Parts of the Bones; and how universally the Distribution of the Liquors is made, the whole bony Substance being tinctured. Whether the Time which this tincturing Liquor takes to pass from the exterior to the internal Laminæ, till all are made of its Colour; and the Time which the Disappearing of the Dye, after giving the Creature no-

The Arteries of the Bones are larger near each Extremity than at the Middle of the larger Bones that are much moved, becauſe they not only ſerve the bony Laminæ near the Extremities, but paſs through them to the Marrow. As Animals advance in Age, the Arteries of the Bones become leſs capacious, as is very evident: Firſt, From the Bones of Adults having leſs Blood in them, than thoſe of Children. Secondly, From their becoming incapable in old Age of admitting the Colouring in Injections, which eaſily paſs in Youth. And, Laſtly, From the Bones of old Creatures being more difficultly tinged with Madder than thoſe of young Subjects.

As the Veins of the Perioſteum cannot be filled with Injection, we are not to expect that their Branches, the Veins of the Bones, ſhould; as they are to be ſeen diſtinct and minute; but we may conclude from Arteries being accompanied with Veins and Nerves *, ſo far as we can trace them in every other Part of the Body, that there are alſo Veins in the Bones; and the diſappearing of the Tincture of Madder could not be without them †. From

no more of this ſort of Food, makes us think it takes to return, are the ſame which the natural Liquors may circulate, is uncertain; becauſe this tinging Subſtance may not be ſo fit for circulating in the Veſſels, as the natural Liquors are.

* If the Authors be not miſtaken, the Arteries of Bones have ſometimes become very large. DIEMERBROECK relates an Obſervation of an Artery in the anterior middle Part of a carious Tibia, the Pulſation of which he ſaw evidently for ſome Days; and MERY demonſtrated to the Royal Academy at Paris, a large Artery paſſing through a ſolid hard Bone.

† As the Nerves cannot be diſtinctly ſhewn by Diſſection; whence it might be inferred that they have no Nerves diſtributed to them, but the general Tenor of Nature, which beſtows Nerves to all the other Parts, ſhould prevent our drawing ſuch a Concluſion: And if Senſibility is a ſure Proof of Nerves entering into the Compoſition of any Part of the Bones; for the granulated red Fleſh which ſpouts out from them, after an Amputation of

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From what has been said of the Vessels of Bones, it is evident that there is a constant Circulation of Fluids in every Part of them, and that there is a perpetual Waste and Renovation of the Particles which compose the solid Fibres of Bones, as well as in other Parts of the Body; the Addition from the Fluids exceeding the Waste during the Growth of the Bones, the Renewal and Waste keeping pretty near Par in Adults of middle Age, and the Waste exceeding the Supply from the Liquors in old Age, as is demonstrable from their Weight; for each Bone increases in Weight as a Person approaches to Maturity, continues of nearly the same Weight till old Age begins, and then becomes lighter. The specific Gravity of the solid Sides, on the contrary, increases by Age; for then they become more hard, compact, and dense. In consequence of this, the Bones of old People are thinner and firmer in their Sides, and have larger Cavities than those of young Subjects.

Viewing the internal Surface of the solid Bones, we see the Orifices or Canals, which pass exteriorly through the Laminæ, to open into other Apertures that are in a longitudinal Direction, from which other transverse Passages egress to terminate in other longitudinal Canals, and this Structure is continued through the whole Substance of the Bone,

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an Extremity, or performing the Operation of the Trepan, or after an Exfoliation, is exquisitely sensible: and in some Caries, where the Periosteum was separated, the Patient suffered racking Pain, if the Bone was touched with a rough Instrument; nor was he free of Pain after the Bone was perforated. The Reason why the Nerves of rigid hard Bones become insensible, is, that all Nerves must have a considerable Degree of Flexibility at the Part where Objects are applied, otherwise they cannot be affected by the Impressions of Objects. We see this illustrated in a very common analogous Case, the Growth of a new Nail; when the former one has suppurated off, the thin Membrane which first appears is exquisitely sensible, but gradually becomes dull in its Sensation, till it can be cut or scraped without causing Pain, when it is formed into a hard Nail.

both

both these kinds of Canals becoming gradually smaller as they approach the external Surface. These Canals may be easily seen in calcined Bone; when broken transversly, the Orifices of the longitudinal Canals are in View; and, when we separate the Laminæ, the transverse ones are to be observed. Here, however, we are not to make these Sorts of Canals more numerous than they really are, because, as MORGAANI has remarked, the Foramina made by the transverse Processes connecting the Laminæ of the Bone, will have the Appearance of the transverse, and the Passages for the Blood-vessels resemble the longitudinal Canals. However, the transverse Canals may be distinguished between the two Kinds of longitudinal ones; those for the Passages of the Vessels are largest near the external Surface of the Bone, and every transverse Section of them is circular; whereas the longitudinal Canals are largest near the Cancelli, and their transverse Sections appear to me to be of a flat oval Figure, which may be owing to the different Momentum of the Fluids conveyed into them. The Situation of the larger Vessels makes a Bone appear more dense and compact in the Middle of its solid Sides, than towards its outer and inner Surfaces, where it is spongy.

* This vascular Texture of Bones must make them subject to Obstructions, Ecchymoses, Ulcers, Gangrenes, and most other Diseases which the softer Parts are affected with; and therefore there may be a greater Variety of Caries than is commonly described. Hence we can account for the following Appearances:

Hæmorrhages from spongeous Flesh rising out from the most solid Part of a cut Bone.

The regular alternate Elevation and Subsiding, or apparent Pulsation, so frequently to be seen in some of the Cells of a carious Bone.

Cells resembling Cancelli, sometimes seen in the Part of a Bone, which in a natural State is the most solid and firm.

A Bone calcinated as a Tube, including another within it.

We see Marrow contained in the larger transverse and longitudinal Canals just now described, and from thence judge that it passes also into the smaller ones. The Drops of Oil which we discover with a Microscope every where on the Surface of a recent, transverse, fractured Bone, and the ouzing of Oil through the most solid Bones of a Skeleton, which renders them greasy and yellow, are a Confirmation of the Use of these Canals. Of what Advantage this Distribution of the Marrow through the Substance of Bones is, will be pointed out, after the Nature of this animal Oil has been inquired into.

The spongy Substance appears clearly enough to be made up of irregular Portions, or Fragments, of both the internal Laminæ, and of the Extremities of all that are between these and the exterior.

These Portions of Laminæ appear, in some Places, to have something of a regular Disposition; for, from the Middle of the Bone to its superior Extremity, the Fragments from the external Laminæ follow nearly the same Direction with the Laminæ themselves; but in those that lie more internally, and are consequently shorter; these Laminæ gradually leave the Circumference of the Bone, and turn towards its Axis, or that Line which may be imagined to run in the Middle of the Bone through its whole Length. From this Disposition they seem to form several Hives, placed one upon another, the small Distances left between them being filled by another numerous Order of little Laminæ, situated some more, some less, transversly.

Below the middle of the Femur, and towards the inferior Extremity, the Fragments are more disposed according to the Length of the Bone; and Laminæ, which fill up the Spaces between them, are more transverse: It may be remarked

marked likewife, that thefe Laminæ in many Places, and principally towards the Ends of the Bone, feem to degenerate into fmall Filaments of different Sizes; which, together with the Laminæ from which they arife, reprefent a kind of Sponge.

In the cellular Subftance of both Ends of the Bone, fome Marks of the original Union of its Epiphyfes are often to be feen. In Children, each of thefe Marks has a thick Stratum of cartilaginous Matter, which, as they grow up, becomes gradually thinner and harder, and at length offifies. In many Subjects, thefe marks are totally effaced, the Epiphyfes then becoming true Apophyfes, or, at leaft, infeparable from the Body of the Bone, as Apophyfes are. In other Subjects, this Offification remains long without being completed; and thus the Epiphyfes may be, either by Art or Accident, loofened and parted from the Bone.

The Femur furnifhes us with an Example, not only of the three different Subftances in Bones, but alfo of the different Kinds of internal Cavities; we fee one large cylindrical Cavity, through the whole Length of its middle Part; alfo numerous leffer Cells of various Figures and Dimenfions, formed in the Interftices of the cellulous Subftance in both Extremities; and, laftly, little Apertures in the Interftices of the reticular Subftance, where the Filaments are mingled with the Laminæ in the fpongy Part. We may likewife obferve the fmall Ducts, which are either diftributed through the Subftance of the Bone, or penetrate it all the Way to the Marrow. The Exiftence of the invifible Pores is likewife demonftrated, through which the Marrow tranfudes, being firft conveyed through the whole Thicknefs of the Bone.

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The Substance of Bones examined chymically by the Retort, will afford * Spirit, Water, Salt, and Oil. After which, there remains in the Retort, a small earthy Substance, retaining only the exact Figures of the Bones employed, but very friable; and the Spirit produced from them may be rectified, or separated into Water, Salt, and Oil.

Hence it appears, that Bones are composed of four Principles or Elements; therefore they are the most proper Materials for forming Vessels, that are to undergo the greatest Force of Fire, being scarce capable of vitrifying, which other Substances are very liable to. This Earth would seem to be the proper constituent solid Part of Bones; for the Quantity of it is great, greater, says HAVERS, than all the other Principles taken together; and after all the others are separated from a Bone, its former Shape still remains, though it becomes so friable as to moulder into Dust on the least Touch; and when moistened with a little Water or Oil, it recovers some Degree of Tenacity, but can never be restored to its former Firmness; since it is not possible by any Art, to reduce Bones to their natural State, when once they are changed, and have their several Principles separated by a chymical Analysis.

Therefore the Solidity of Bones increases by Age, in Proportion of the terrestrial Particles becomes greater, while some of these degenerate from their State; whence we may judge why the Bones of old People are more friable than those of young ones.

Though the Bones so far agree in their Structure and annexed Parts, yet we may observe a considerable Difference among them in their Magni-

* This succeeds best with the Bones of Infants.

tude,

tude, Figures, Situation, Subftance, Connection, Ufes, &c. from which Authors have taken occafion to divide them into as many different Claffes. But thefe being fo obvious to ocular Infpection, I fhall content myfelf with mentioning only one of them; which, as it is at firft Sight very remarkable, fo it comprehends very near the whole Bones of the Body, and at the fame Time leads us to examine the moft confiderable Variety that is to be found in the Difpofition of their conftituent Parts and in their Ufes, which is, that fome Bones are broad and flat, while others are long and round.

The broad Bones have thin Sides as the Laminæ, being foon and equally fent off to form the Cancelli; and this Lattice-work is thicker, and nearly of an equal Form throughout. By this Structure they are well adapted to their Ufes, to afford a Surface large enough for the Mufcles to rife from, and move upon, and defend the Parts which they inclofe.

The round Bones have thick ftrong Walls in the Middle, and become very thin towards their Ends; which is owing to fome few Laminæ feparating at their Middle, and, on that Account, the Cancelli are fo fine and fmall, that they are not taken notice of: But fuch Bones are faid to have a large Refervoir of Oil in this Place. Towards their Extremities, the Cancelli become very thick, and rather more complete than in the other Sort of Bones. Thefe round Bones are naturally very ftrong, and being expofed to violent Injuries, have need of a cylindrical Figure to refift external Preffure, and of a confiderable Quantity of Oil to preferve them from becoming too brittle. Befides which, they are advantageoufly provided with thick Sides towards their Middle, where the greateft Force is applied to injure them; while their Hol-

Hollowneſs increaſes their Diameter, and conſequently their Strength to reſiſt the Violence applied to break them tranſverſly, as has been demonſtrated by GALILÆUS. Thus, for inſtance, in eſtimating the proportionable Reſiſtance of two cylindrical Bones of unequal Diameters, but conſiſting of an equal Number of ſimilar Fibres uniformly diſpoſed round each, it is plain:

1. That the abſolute Force of theſe two Bones is equal, becauſe they conſiſt of equal Numbers of ſimilar Fibres.

2. That the abſolute Force of all the Fibres in each Bone will have the ſame Effect in reſiſting any Power applied to break them, as if the Sum of all their Forces was united in the reſpective Centers of the tranſverſe Sections where the Fractures are to be made. For by Hypotheſis, the Fibres being uniformly diſpoſed in each, there is not any Fibre in either Bone that has not a correſponding Fibre; the Sum of both whoſe Diſtances from the Axis of Renovation (about which all the Parts of the Bone muſt revolt in breaking) is equal to two Semidiameters of the Bone: Conſequently each Fibre, and all the Fibres, may be regarded as reſiſting at the Diſtance of one Semidiameter or Radius from this Axis, that is, in the Center.

3. Since the united Force of all the Fibres is to be regarded as reſiſting at a Diſtance from the Center of Motion equal to the Semidiameter, it follows that the total Reſiſtance of all theſe Fibres, or the Strength of the Bone will be proportionable to its Semidiameter, and conſequently to its Diameter.

I have here taken for an Example one of the moſt ſimple Caſes for calculating the proportionable Force

Force of Bones; but was it not too foreign to the present Design, it might be universally demonstrated, that of whatever Figure Bones are, and in whatever Manner their Fibres are disposed, their Strength must always be in a Ratio compounded of the Area of their transverse Sections, or of their Quantity of bony Matter, or of the Distance of the Center of Gravity of these Sections from the Center of Motion, or Fulcrum, on which the Bone is supposed to be broken.

Since therefore the Strength of Bones depends on their Number of Fibres or Quantity of Matter, and the Largeness of their Diameters, one may conclude, that the Part of a Bone formerly fractured, and reunited by a Callus, must be stronger than it was before the Fracture happened; because both these Advantages are obtained from the Callus: Which is a wise Provision, since Bones are never set in such exact a Direction as they were naturally of; and then wherever a Callus is formed, there is such an Obstruction of the Vessels, that if the Bone was again broke in the same Place, the ossific Matter could not so easily be conveyed to reunite it. This Callus may indeed, for want of Comprehension, be allowed to form a spongy cellular Substance, as RUYSCH says, he has sometimes seen it; but even in this Case the Strength of the Bone at this Part would be still increased by one or both the Causes abovementioned.

However solid and compact adult Bones are, yet they were once Cartilages, Membranes, nay a mere Gelly. This needs no further Proof, than repeated Observations of Embryos when dissected: And how much more tender must the Bones be before that Time, when neither Knife nor Eye is capable to discover the least Rudiments of them? By degrees they become more solid, then assume the

the Nature of Cartilage, and at last ossify. The Cohesion of their Laminæ and Fibres always increasing in Proportion to their increased Solidities, as is evident from the Time necessary to unravel the Texture of Bones of People of different Ages, or of dense and spongy Bones, or of the different Parts of the same Bone, and from the more tedious Exfoliations of the Bones of Adults than of Children.

The Induration of Bones is chiefly owing to their being exposed more than any other Parts to the strong Pressure of the great Weights they support, to the violent Contraction of the Muscles fixed to them, and to the Force of the Parts they contain, which endeavour to make Way for their own further Growth. By all this pressing Force the solid Fibres and Vessels of the Bones are thrust closer, and such Particles of the Fluids conveyed in these Vessels as are fit to be united to the Fibres, are sooner and more firmly incorporated with them, while the remaining Fluids are forcibly driven out by the Veins to be mixed with the Mass of Blood. In consequence of this, the Vessels gradually diminish as the Bones harden. From which again we can understand one Reason, why the Bones of young Creatures sooner reunite after a Fracture, than those of old; and why Horses, Bullocks, and other Creatures, whose young are numerous, decay in their Size, when put too soon to hard Labour.

That the ossifying of Bones greatly depends on Pressure, seems to be evinced from the frequent Examples we meet with of other Parts turning bony, when long exposed to the compressing Force of the surrounding Parts, or when they are subjected to the like Circumstances by their own frequent and violent Contraction. Witness Bones frequently found near the Base of the Heart in

some

ſome old Men, and in ſeveral other Creatures; nay, the muſcular Subſtance of the Heart has oſſified and the Arteries of old Men often become oſſeous. The Cartilages of the Larynx are generally oſſified in Adults. In Beaſts of Burden the Cartilages between the Vertebræ of the Back very often change into complete Bones, and being intimately united with the Vertebræ, the whole appears one continued Bone. Nor is the Perioſteum exempt from ſuch an Induration; for PEYER tells us, he divided this Membrane into ſeveral bony Laminæ.

To confirm this Argument ſtill further, we may obſerve, That Bones begin their Oſſification at the Places where they are moſt expoſed to theſe Cauſes, viz. in the cylindrical Bones from a middle Ring, and in the broad ones, at or near their Center, from one or more diſtinct Points. The Reaſon of which is, that theſe Parts are contiguous to the Bellies of the Muſcles annexed to the Bones, where the Swelling of theſe moving Powers is greateſt. What the Effects of this may be, let any judge who view ſome of the Bones, as the Scapula and Oſſa Ilium, which are covered with Muſcles on each Side; how compact and thin they are in Adults, where the Bellies of the Muſcles were lodged; whereas in Children they are thicker. But this being the middle Part of theſe Bones, where the greateſt Number of Fibres is, this particular Place would have been much thicker in Adults, had not this forcible Cauſe been applied, which has not had ſuch Effects in Children, whoſe Muſcles have not been much exerciſed. Beſides, if we allow that all the Parts of a Bone are equally increaſed by the conſtant Supply of new Particles, each Fibre, and every Particle of a Fibre, will endeavour to make Way for its own Growth, by puſhing the one next to it; and conſequently by

far

far the greatest Pressure will be on the Middle: Wherefore the Particles there will be made most firm: And here it is that Bones begin their Ossification. Lastly, the Pulsation of the medullary Arteries, which enter the Bones near to this middle Part, may, as Authors have alledged, contribute perhaps somewhat to this Induration.

From the Effects of Pressure only it is, that we can account for the Bones of old People having their Sides so much thinner, yet more dense and solid, while the Cavities are so much larger than in those of young People; and for the Impressions of Muscles, Vessels, &c. being so much more strongly marked on the Surfaces of the former than of the latter, if they belong to People of near the same Condition in Life. Pressure must likewise be the Cause which in People of equal Ages makes these Impressions stronger in the Bones of those who have had much Labour and Exercise, than they are found in People who have led an indolent unactive Life.

It is also probable, that Ossification depends on the Vessels of the Bones being so disposed, and of such Diameters, as to separate a Liquor, which may easily, when deprived of its thinner Parts, turn into a bony Substance; as seems plainly from the Observation of the cellulous Matter separated after Fractures and Ulcers, where Part of the Bone is taken out: For in these Cases this Liquor ouzing out from the open Orifices of the lacerated Vessels is gradually formed into granulated Flesh; which extends itself so as to fill up all the Space where the Bone is taken from, then hardens, till it becomes as firm as any other Part of the Bone. This happens frequently, even when the Ends of the diseased Bone are at a considerable Distance from each other, as several Cases, and of

of which there are remarkable Inſtances handed down by Authors.

Perhaps both the Cauſes of Oſſification above-mentioned, may be aſſiſted by the Nature of the Climate live in, and the Food they uſe. Whence, in hot Countries, the Inhabitants ſooner come to their Height of Stature, then in the northerly cold Regions: And thence ſeems to have ariſen the common Practice among the Ladies of making Puppies drink Brandy, or Spirit of Wine, and of bathing them in theſe Liquors, to prevent their growing big. Nay, it has been obſerved, that much Uſe of ſuch Spirits has occaſioned Parts, naturally ſoft, to putrify in ſome, and to oſſify in other People of no great Age. Witneſs the Caſes related by LITTRE and GEOFFROY *.

From the foregoing Account of the Structure of Bones, and of their Oſſification, we may underſtand the Reaſons of the following Phænomena:

How Bones may be ſoftned or diſſolved.

How the natural Colour of the Bones may be changed by ſome ſorts of Food.

Why the Bones of ſome People are ſo long in hardening, and in others never compleatly indurate.

Why in ſuch whoſe Oſſification is very ſlow, the Bones are generally thicker in Proportion to their Lengths, eſpecially at their Extremities, as in the Rickets.

How hard firm Bones are become ſoft and pliable by Diſeaſes.

How in ſome Caſes the Bones may waſte and diminiſh.

How the Bones may become ſolid all through, without any Appearance of Cancelli.

Why the Epiphyſes ſeparate from the Bones in ſome Diſeaſes.

* Memoires & Hiſt. de l'Acad. des Sciences, 1706.

How Nodes, Tophi, and Exoſtoſes happen after the Eroſion of the external Laminæ of the Bones in the Lues Venerea, Scurvy, Rheumatiſm, and Gout.

What occaſions ſometimes ſuch Difficulty in curing fractured Bones, or why they never reunite, tho' they are reduced, and all proper Means towards a Cure are uſed.

Why Calluſes, after Fractures, are ſometimes very thick and protuberant.

What Difference there ought to be in the Application of Bandages to Fractures of old and young Subjects *.

The Marrow is of very conſiderable Uſe to the Bones; for by entering their tranſverſe Canals, and paſſing from them into the longitudinal ones, which is communicated to all the Laminæ, to ſoften and preſerve them from becoming too brittle; and conſequently the Bones are kept ſtronger to reſiſt Injuries. How far this Oil contributes to the Firmneſs of the Bones, is ſufficiently demonſtrated, by obſerving their Brittleneſs, when it is conſumed, or loſes its oleaginous Conſiſtence, as in ſcorbutic pocky Subjects, in old People, or in ſuch Bones as have been deprived of this Oil by Fire or otherwiſe.

Beſides this Advantage which the Subſtance of the Bones has from the Marrow, their Articulations are ſaid to receive no leſs Benefit; for there are

* Whoever is deſirous to know in what Time and Order each Bone and its ſeveral Parts begin to aſſume a bony Nature, let him conſult KERCKRINGIUS, who gives us the Delineations of Abortions from three Days after Conception, and traces the Oſſification of the Bones from three Weeks and a Month, till the Time of the Birth: To whom ſhould be added COITERUS and EYSSONIUS. An Account of this Subject might alſo be collected out of RUYSCH's Works, where ſome of the Miſtakes committed by the former Authors are corrected, and ſeveral more Particulars to make the Hiſtory of the Oſteogenea more accurate, have ſince been added by NESBITT and ALBINUS.

ſeveral

several Apertures near the large Articulations, which communicate with the medullary Cells, and transmit the Oil to the Articulations, as is evident from the Marrow found often congealed in those Pores of fat Animals. Then, all the Parts concerned in the Motion of the Joint will be lubricated; and when the Mucilage secreted here, (to be afterwards described) is incorporated with the Oil, one of the most effectual Mixtures is formed for such a Use *.

When the Marrow, after having served for the Uses mentioned, is reassumed in the Mass of Blood, (as it is continually, in common with all the other secreted Liquors that have not Passages formed for conveying them out of the Body) it corrects the too great Acrimony communicated to the saline Particles of our Fluids, by their Circulation and Heat; in the same Manner as the lixivial Salts are blunted by Oil in making Soap. Hence in acute Diseases, the Marrow, as well as the other oleaginous Substances of the Body, is quickly wasted †.

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* The Quantity of this Liquor supplied to the Articulations, is always in Proportion to the Quantity of Motion performed by the Joints; and hence by Exercise or Labour, the Quantity of Marrow is diminished; so that Butchers can tell, by looking at the Bones of slaughtered Beasts, whether they have lately come off a Journey, or no.

† As the Nature of all Oil is to become thin and rancid, when exposed long to Heat, we may thence, and from the Structure of the Bones, see why such an ungrateful Smell and black thin Ichor proceed from corrupted Bones, rather than from any other Part of the Body; and can understand the Reason of the Changes of Colour which Bones undergo, according to their different Degrees of Mortification. Hence, likewise, we may learn the Cause of a Spina ventosa, and of the Difficulty of curing such Caries of Bones as proceed from an Obstruction, and consequently Putrefaction of the Marrow, and of a quick Pulse, Thirst, and hectic Paroxysms so often attending these Diseases in the Bones. And from these Phænomena we may deduce the Reason of the fatal Prognosis taken from black fœtid Urine in Fevers.

Of the Marrow and Medullary Membrane of the Bone.

The greateft Part of the Bones contain in their Cavities or Cells an unctuous fat Subftance of a folid Confiftence in fome, and foft in others. It is called by the general Name of Marrow, efpecially that which lies in the large Cavities of the long Bones. That which is difperfed in the fmall cellulous Cavities is likewife called the Medullary Juice.

The Marrow is a Mafs, compofed of an Infinity of fine Veficles or membranous Cells joined together, and communicating with each other, furnifhed with Blood-Veffels and Nerves, and filled with a fine fweet aleaginous Matter, fecreted from the Blood.

All thefe Cells or membranous Veficles are furrounded by a very fine Membrane, which is like an internal Periofteum, fticks clofe to the interior Surface of the Bone, by means of an infinite Number of capillary Veffels, and of feveral other kinds of very fmall Filaments. The reticular Subftance of the Bones runs through this medullary Mafs, and as it were interlards it, and by this means fuftains it in the middle of the great Cavities.

The Marrow of the cellulous or cavernous Subftance of Bones is divided by fmall offeous Septa or Laminæ, and by the Filaments of the reticular Subftance of Bones, into a vaft Number of Veficles or membranous Cells which line the offeous Cells, and communicate with each other. This Cellular in the cavernous Texture of Bones differs from that in the great Cavities both in Colour and Confiftence. It is liquid, and almoft quite of a red Colour, whereas the other is much more folid, and is often of a red Colour only on it's Surface.

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The Difference is owing to the sanguiferous Vessels which run through each membranous Cell; whereas the Marrow in the great Cavities seems to be furnished with them in the common Membrane only. Many of those medullary Cells are likewise divided by the bony Filaments of a cavernous Substance, and these small Filaments, as well as those of the reticular Texture, are inclosed by Portions of the medullary Membrane, as an internal Periosteum *.

But it is to both these Substances taken together, that Anatomists give the Name of Marrow, not to either of them taken singly. The medullary Membrane is very sensible, but not the Juice, which is necessary to be observed to understand what is meant by the Sensibility of the Marrow †.

The sanguiferous VESSELS of the BONES, and their Appendices.

They may be reduced to three Classes. Some go to the external Parts of Bones, to the Ligaments, Cartilages, mucilaginous Glands, and Periosteum. Others penetrate the Substance of the Bone, and the third Kind goes all the Way to the internal Cavities, and is distributed to the medullary Membrane, and disposing the oleaginous Particles from the Blood, makes what is called Marrow.

The Vessels of the first Class, that is, those spread on the external Parts of Cones, are the Ramifications

* The medullary Membranes may be separated from the Liquor which they contain, by steeping the whole Mass in very hot Water, and afterwards compressing it by gentle Degrees.

† We may imitate the Fat or Marrow of any Animal, by taking Oil of Olives, and pour it upon Spirit of Nitre; then digest them for some Days. By degrees the Oil becomes of the Colour of Marrow, and at last is congealed or hardened into a white Fat, as that of any Animals. Hence it appears, that animal Fat, or Marrow, is but coagulated of the oleaginous Particles of the Blood.

of thofe which go to the circumjacent Mufcles, and other Parts contiguous to the Bones. The greateft Number of them go to the Periofteum, and run in between its different Laminæ, being divided into an infinite Number of capillary Ramifications, difpofed in a reticular Manner by their frequent Communications. [I fhall not here take upon me to determine whether this Membrane has any particular elaftic Force, by which it can increafe that of the fanguiferous Veffels.]

The Veffels of the fecond Clafs, or thofe of the Subftance of Bones, are Productions or Continuations of thofe of the Periofteum, which enter the Pores of the Bones like very fine Filaments, and run longitudinally between the offeous Fibres. The Exiftence of thefe fmall Veffels are very evident in Fractures, efpecially in young People.

Thefe Arteries and Veins do not here accompany each other as in other Parts of the Body, but run in oppofite Directions till they meet. This Conjecture is founded on the different Obliquity of certain Foraminæ. It muft not, however, be imagined, that all Arteries enter at one End of the long Bones, and that the Veins go out at the other; the Reunion of fractured Bones is fufficient to deftroy this Opinion.

The Veffels that go to the inner Subftance of the Bones, not only through the external Pores, but alfo through thofe of all the inner Cavities, both great and fmall, being detached from the medullary Membrane in the fame Manner, as from the Periofteum.

Thefe Arteries and Veins of this Clafs often accompany each other as they pafs through the Bones, and fometimes each paffes through a feparate Aperture.

Thofe of the firft Clafs ferve chiefly to nourifh the external Parts of the Bones, and to furnifh the

mucilaginous Glands with the Liquor secreted in them. Those of the second Class furnish the nutritious Juice of the internal Substance of the Bones. Those of the third Class come likewise from the Periosteum. They appear to be destined chiefly for the Formation of the Marrow and medullary Juice, and are spread in great Numbers over the Membranes of each. They enter the Cavities of the concave Bones through the oblique Orifices in their solid Substance, and into the Cells by other small Apertures; ramifying themselves in all Directions, not only on the Membranes of the Marrow and medullary Juice, but likewise through the Substance of the Bones in their Passage to the internal Cavities.

Of the Cartilages.

A Cartilage is a whitish or pearl-coloured Substance, which covers the Extremities of Bones joined together by moveable Articulations, increases the Volume of some of them after the manner of Epiphyses, unites others very closely together, and has no immediate Adhesion or Connection with others.

Cartilages are solid, smooth, white, elastic Substances, between the Hardness of a Bone and Ligament; and covered with a Membrane named Perichondrium, which is of the same Structure and Use as the Periosteum, but not so sensible.

The Cartilages are formed of Laminæ much of the same Nature of some Bone; its Cohesion differ in various Parts, and have no Cancelli, more tender and less friable than that of Bones; they are pliable and elastic, but with Age they sometimes grow so hard as to ossify.

Cartilages are subject to Exfoliation, as well as Bones: We best see their Structure, by boiling or exposing them to the Weather.

The Cartilages which unite to the Bones are of four Kinds.

Some cover both Sides of the moveable Articulations, and are very smooth and slippery.

Some unite the Bones to each other, either so firmly as to allow no sensible Motion, as in the Symphysis of the Ossa Pubis, and still more in that by which the Epiphyses are joined to the Bones; or in such a Manner as to allow of different Motions, as in those by which the Bodies of the Vertebræ are connected. The first grow easily hard, the others appear in some measure viscid, and retain their Flexibility.

Some increase the Size and Extent of Bones. Of these again, some are articulated with other Bones, as the cartilaginous Portions of almost all the true Ribs; or with other Cartilages, as the Septum Narium; others serve only for Borders, as those of the Basis of the Scapula, and of the Crista of the Os Ileum, the Supercilia of Cavities, and those of the spinal and transverse Processes of the Vertebræ.

Some, in fine, have a singular Form, as those of the Ears, and most of those of the Nose; in which last, their Elasticity appears most sensibly.

The Cartilages belonging to the second general Class, or those not immediately joined to Bones, are, for the most Part, placed in moveable Joints; and may likewise be subdivided into several Kinds.

Some lie altogether loose, being joined neither to the articulated Bones nor to the Cartilages which cover them, but slide freely between them in different Directions; as those which are placed in the Articulation of the Tibia with the Femur; in that of the inferior Maxilla, with the Ossa Temporum;

porum; and in that of the Clavicle with the Sternum. These between the Clavicle and Acromium, and between the first and second Cervical Vertebræ are of the same Kind. Some partly joined to other Cartilages, and partly slide between the cartilaginous Extremities of the articulated Bones, as the Cartilage at the inferior Extremity of the Radius.

We might likewise reckon among the Cartilages, though more improperly, several of the small sesamoïde Bones which remain long cartilaginous, and also the cartilaginous Portions of Tendons, which do the same Office with sesamoïde Bones.

The Cartilages are composed of Laminæ disposed much in the same Manner as those of the Bones, as might be reasonably concluded from observing Bones in a cartilaginous State before they ossify; and from seeing so many Cartilages become osseous: This may be still farther confirmed, by the Exfoliation which Cartilages are subject to, as well as Bones; and a Demonstration can be given of their Structure, after boiling, burning, or exposing them to the Weather.

While Cartilages are in a natural State, it is to be remarked; First, That they have no Cavity in their Middle for Marrow. Secondly, That their exterior Surface is softest, which renders them more flexible; from this it is, that injected Liquors easily fill the Vessels on their Surface, but seldom reach to their middle solid Part. And Lastly, That as the specific Gravity of Cartilages is near a Third less than that of Bones, so the Cohesion of their several Laminæ is not so strong as in Bones; whence Cartilages laid bare in Wounds or Ulcers, are more liable to corrupt, and exfoliate much sooner than Bones.

Cartilages seem to be principally kept from ossifying, either by being subjected to alternate Motions

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tions of Flexion and Extenfion, the Effects of which are very different from any kind of fimple Preffure, or by being conftantly moiftened; thus the Cartilages on the articulated Extremities of the great Bones, and the moveable ones placed between the moving Bones in fome Articulations, which are obliged to fuffer many and different Flexions, and are plentifully moiftened, fcarce ever change into Bone, while thofe of the Ribs and Larynx are often found offified. The middle angular Part of the Cartilages of the Ribs, which is conftantly in an alternate State of Flexion and Extenfion, by being moved in Refpiration, is always the laft becoming bony. In the Larynx, the Epiglottis, which is oftener bended and more moiftened than the other four Cartilages, feldom is offified, while the others as feldom efcape it in Adults.

The Cartilages begin to offify on their external Surface, unlefs when Moifture or Flexion impede it; and the Offification proceeds internally till the Cancelli are at laft formed, when a fort of Marrow is depofited into them: While this Charge is bringing about in the Subftance of the Cartilages, their Blood Veffels gradually appear bigger towards their internal Subftance, and lefs on the external.

The Cartilages, being naturally of fuch firm Subftance, and of a Compofition akin to the Bones, will gradually acquire greater Solidity by conftant Preffure; and this Change will be made fooneft and moft remarkably, where the Preffure is greateft, that is, at their external Suface. The exterior Laminæ, when offified, are more compact and denfe than formerly, and therefore they will have a ftronger Power of attracting thofe in Contract with them; while the Branches of Veffels diftributed to the firft offified Lamella, and thofe

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that run in the Interstices of the Fibres of this and the Laminæ next to it, being now more compressed than formerly, will have a less Quantity of Fluids passing through them, and consequently the other Branches will receive a proportionably larger Quantity; the Momentum of which, joined to that Power of Attraction or or Force of Cohesion, increased by the greater Solidity of the Laminæ, will increase the Pressure upon more internal Laminæ, and hasten their hardening; after which, these last Laminæ will produce the same Effects on the other contiguous to them: And thus the Ossification must go on till all are become osseous. The Body thus changed, will have its former Dimensions, or nearly so, because its external Part ossified first, and being rigid, yields little or nothing to the Powers that draw it towards the Axis of the Bone. But seeing the new Particles added from the circulating Fluids, during the Ossification, do not compensate for the Condensation which all the Particles undergo, and thereby the Laminæ occupy less Space than they did while in a cartilaginous State, a Cavity is left in the Middle. And as all the Laminæ cohere and have cross Fibres joining them, many of these Fibres are stretched irregularly from one Side of the Cavity to the other, and therefore form the Cancelli. The Branches of the Vessels formerly distributed to the Laminæ being now much lessened, the remaining Branches which run transversly, are frequently proportionably increased, become very conspicuous, and are dispersed every where in the Cavity, to serve for the Secretion of Marrow. Thus, this flexible elastic solid Substance becomes a rigid inflexible cavernous Bone with Marrow contained in its Cancelli.

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The Cartilages subservient to Bones are, as CELSUS observes, sometimes found on the Extremities of those which are joined to no other; but are never wanting on the Ends and in the Cavities of such Bones as are designed for Motion: And in more than one Instance, Cartilages are interposed between such other Cartilages as cover the Heads and Cavities of articulated Bones; nay, they are also placed between immoveable ones.

The Uses of Cartilages, so far as they regard the Bones, are to allow, by their Smoothness, such Bones as are designed for Motion to slide easily without Detrition; while by their Flexibility they accommodate themselves to the several Figures necessary in different Motions, and by their Elasticity they recover their natural Position and Shape, as soon as the Pressure is removed. This springy Force may also assist the Motion of the Joint to be more expeditious. To these Cartilages we chiefly owe the Security of the moveable Articulations: For without them the osseous Fibres would sprout out, and intimately coalesce with the annecting Bone; whence a true Anchylosis must necessarily follow; which never fails to happen when the Cartilages are eroded, as already observed. The moveable Cartilages, interposed in Articulations, serve to make the Motions both freer and more safe than they would otherwise be. Those placed on the Extremity of Bones that are not articulated, as, on the Spine of the Ileum, Base of the Scapula, &c. serve to prevent the bony Fibres from growing out too far. Cartilages sometimes serve as Ligaments either to fasten together Bones that are immoveably joined, such are the Cartilages between the Os Sacrum and Os Ileum, the Os Pubis, &c. or to connect Bones that enjoy manifest Motion, as those between the

Bodies

Bodies of the true Vertebræ, &c. Cartilages very often do the Office of Bones to greater Advantage than the last could; as in the Brims of the Cavities, those of the Ribs, &c. Cartilages which supply Brims of Cavities, &c.

The Ligaments of Bones.

A Ligament is a white, fibrous, close, compact Substance more flexible than a Cartilage, not easily ruptured or torn, and which does not yield, or at least but very little, when pulled.

It is made up of very small and very strong Fibres, which by their different Texture and Disposition, form narrow Cords, broad or thin Membranes; and these serve to bind, contain, limit, and defend the other Parts hoth hard and soft.

I am not here to speak of the Ligaments peculiar to the soft Parts; but confine myself wholly to those which belong to Bones or Cartilages alone. Of these, we may establish two general Classes; the first, containing those Ligaments which are of Use only to the Bones in which they are inserted; the other, containing those which serve for other Parts besides the Bones in which they are fixed, and principally for the Muscles. If we have Regard to the Bones only, these last are improperly termed Ligaments, as not doing the Office of such, and consequently resembling the true Ligaments only in Texture.

Of those Ligaments which are fixed in Bones or Cartilages alone, and are not imployed about the other Parts, some belong wholly to the Articulations or moveable Bones, and others have nothing to do with the Articulations.

The Ligaments which belong particularly to the moveable Articulations may therefore be called articular Ligaments, and are of several kinds.

Some

Some are deſigned only to fix and ſtrengthen the Articulations, and ſecure the Bones in their different Motions, from parting from each other, as it happens in Luxations. Theſe Ligaments are like Ropes, more or leſs flat, or like Membranes, ſometimes narrow, and ſometimes of a conſiderable breadth; and though ſome of them are thin, they are all very ſtrong and yield but little. The Ligaments of the Articulations by Ginglymus, and thoſe that tie the Bodies of the Vertebræ together, are of this kind.

Some contain a very fluid mucilaginous Liquor commonly called Synovia, which continually moiſtens the Articulations. Theſe are not ſo properly Ligaments as ligamentary Membranes, bound immediately round the Articulations, and fixed to the Extremities of the articulated Bones, and thus forming Capſulæ or Bags to contain that Liquor, and hinder it from running out.

Theſe may very well be named Capſular Ligaments. They lie within the former ſort, being cloſely united to their internal Surface, and are to be met with in all the moveable Articulations as in that of the Ulna with the Humerus, thoſe of the Bones of the Carpus with each other, &c. but they are more like Membranes than Ligaments properly ſo called.

Some perform both the former Offices; that of a membranous Ligament to keep the Bones together, and of a Capſula to hold the Mucilage. Theſe ſurround the orbicular Articulations, as that of the Humerus with the Scapula, of the Femur with the Os Innominatum, &c.

All the Parts of theſe Ligaments are not of equal Thickneſs, ſo that they appear to be made up of two kinds of Ligaments inſeparably united or glued together; one Capſular which ſurrounds the whole Articulation, and ſeveral true Ligaments

ments extended to different Distances over the other, and closely united to it. The Name of Orbicular Ligaments is not general, because it does not agree to those of the Bones of the Tarsus, Carpus, &c.

I do not think it proper to rank among these, the membranous Vagina belonging to the Canal or Sinus in the superior Part of the Humerus, which shall be afterwards described.

Some are hid by the Articulations themselves and by the capsular Ligaments, as that belonging to the Head of the Femur, called improperly Ligamentum Teres, and the Crucial Ligaments of the Tibia.

The Ligaments which serve to connect Cartilages with Bones, might be reckoned another Species of articular Ligaments; and of these some are proper, as those belonging to the semilunar Cartilages of the Knee, to the cartilaginous Trochlea of the Orbit, &c. Others are common, as all those to which the inter-articular Cartilages are fastened by their Circumferences.

The other Ligaments of the first Class, or those fixed to Bones without any relation to the Articulations, are of two kinds.

Some of them are loose, and serve only to limit the Motions of Bones; such as those that tie the Clavicles to the coracoïde Apophyses; those that go from one Clavicle to the other, and those between the spinal Apophyses of the Vertebræ.

Some of them are tight, and stretched either between the Parts of the same Bone, as the Ligaments between the Acromium and coracoïde Apophysis, or between several Bones united together without Motion, as those that are fixed by one Extremity to the Os Sacrum, and by the other to the Os Ischium.

The

The Ligaments of the fecond general Clafs, or thofe which being fixed to Bones or Cartilages are likewife of Ufe to other Parts, are of two kinds. Some of them are fixed to Bones or Cartilages only, and fome are likewife fixed to other Parts, or other Parts are fixed to them.

Thofe of the firft Kind ferve chiefly to inclofe, check, limit, and ftrengthen the Mufcles and Tendons, and fometimes to change their Directions.

The annular Ligaments are of this kind, and they antiently had their Name not fo much from their Figure, as from their Ufe, which is much the fame with that of the Rings through which the Reins of Horfes pafs; for it is after the fame manner that thefe Ligaments bridle the Tendons of many Mufcles, and thus hinder them from ftarting from their Places in violent Motions, and in fome Circumftances, change their Directions.

The annular Ligaments are either particular and fimple, or common and made up of feveral fingle ones, as we fhall fee in thofe of the Carpus, Thumb, &c. Some of them are like Vaginæ or Sheaths, as thofe on the internal or flat Side of the firft and fecond Phalanges of the Fingers.

Some of them are only femiannular, as that of the fuperciliary Sciffure of the Orbit, when there is a Ligament there, and that of the Sciffure in the fuperior Cofta of the Scapula.

To thefe might be referred the Ligaments between the Acromium and coracoïde Apophyfis of the Scapula, and between the Os Sacrum and Os Ifchium, which have been already mentioned in the firft Clafs.

Thofe of the other kind which come under this fecond Clafs, comprehend the Ligaments fixed to other Parts as well as to Bones, and thefe again are of two forts.

Some

Some of them are fixed to one or more Bones, with different Degrees of Tenfion; and ferve on each Side for the Infertion of Mufcles, fupplying, in that refpect, the Place of Bones.

Of this Kind are the interoffeous Ligaments of the Fore-arm and Leg, the obturator Ligament; the Ligament extended on each Side of the Humerus, from the Cervix to the Condyles, the pofterior and lateral Ligaments of the Cervix, and the ligamentary Membranes of the pofterior Foramina of the Os Sacrum.

To thefe may be added the Ligaments commonly termed Aponeurofes; fuch as thofe of the Temples, Scapula, Humerus, Ulna, Palm of the Hand, Thigh, Leg, Sole of the Foot, &c. all which fhall be defcribed in their proper Places. And they may, in general, be termed Aponeurotic Ligaments, or ligamentary Aponeurofes, as Septa, ligamentary Vaginæ, &c. But they ought to be carefully diftinguifhed from the aponeurotic Membranes of the Mufcles and Tendons, which fhall be mentioned hereafter. The Ligamentum Sufpenforium of the Mufculus Styloglofus belongs to this Clafs.

Other Differences of Ligaments may be deduced from their Confiftence, Solidity, Thicknefs, Situation, and Figure, as we fhall demonftrate.

Some Ligaments are almoft cartilaginous, as thofe which furround the Head of the Radius, and the fmall Head of the Ulna, a Portion of the orbicular Ligament of the Head of the Femur, and the annular Virginæ of the Fingers.

Some of them have a particular Elafticity; by which they are capable of being drawn out by a fufficient Force, and of contracting again when left to themfelves. This Elafticity differs from that of Cartilages, which laft is hardly perceiveable, but by compreffing or bending them to a

 certain

certain Degree. It differs likewife from that of the other Ligaments, being not only very confiderable in living Bodies, but even remains fuch after Death.

Of this Kind are the Supercilium of the Cotyloïd Cavity, the Ligaments which tie the Os Hyoïdes to the Styloïd Apophyfis, the pofterior cervical Ligament; the Ligaments which connect the fharp Edges of the fpinal Proceffes of the Vertebræ to one another, and thofe feated at the Bafes of thefe Apophyfes next the great Canal of the Vertebræ, efpecially in thofe of the Lumbar *.

The Arteries of Ligaments are very confpicuous after a tolerable Injection, and the Branches of their Veins are fometimes to be feen full of Blood.

Such Ligaments as form the Sides of Cavities, have numerous Orifices of their Arteries opening upon their internal Surface which keep it always moift: If we rub off that Moifture, and then prefs the Ligament, we can fee the Liquor ouzing out from fmall Pores, and we can force thin Liquors injected by the Arteries into the Cavities formed by Ligaments.

Thefe exhaling Arteries muft have correfponding inhaling Veins, otherwife the Cavities would foon be too full of Liquor.

The Ligaments which ferve to connect the moveable Bones, commonly rife from the Conjunction of the Epiphyfes of one Bone, and fall into the fame Place of the other; or where Epiphyfes are not, they are fixed to the Cervix, beyond the Supercilia of the articulated Bones;

* After Maceration in Water, the Ligaments can eafily be divided, and each ligamentous Stratum appears compofed of Fibres, the largeft of which are difpofed in a longitudinal Direction.

and

and after fuch a Manner in both Cafes, as to include the Articulation in a Capfula or Purfe, with this Difference, depending on their different Motions, that where the Motion is only to be in two Directions, the Ligaments are ftrongeft on thofe Sides towards which the Bones are not moved; and when a great Variety of Motions is defigned to be allowed, the Ligaments are weaker than in the former Sort of Articulations, and are nearly of the fame Strength all round.

Befides thefe common circular Ligaments of the Joints, there are in feveral Places particular ones, either for the firmer Conjunction of the articulated Bones, or for reftraining and confining the Motion to fome Side; fuch as the crofs Ligaments of the Femur round it, &c *.

Ligaments are alfo of Service to the Bones in feveral other Refpects; they fupply the Place of Bones in feveral Cafes to Advantage; thus the Parts in the Pelvis are more fafely fupported below by Ligaments, than they could have been by Bone. The Ligaments placed in the Foramina Oveles of the Offa innominata, and between the Bones of the Fore-arm and Leg, afford Frictions to

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* Wherefore Ligaments muft be fubject to the Difeafes common to other Parts where there is a Circulation of Fluids.

Authors generally fay, that Ligaments are infenfible, and confequently it may be inferred, that they have no Nerves diftributed on them; but the violent racking Pain, felt on the leaft Motion of a Joint labouring under a Rheumatifm, the Seat of which Difeafe feems often to be in the Ligaments, and the infufferable Torture occafioned by a Collection of acrid Matter in a Joint, or by Tophi in the Gout, would perfuade us that they are fupplied with Nerves.

* Fabricius ab Aquapendente's Obfervation will appear juft, that cæteris paribus, in whatever Articulation, the Ligaments are few, long, and weak, the Motion will be more free and quick, but Luxations will frequently happen; and, on the contrary, where the Ligaments are numerous, fhort, and ftrong, the Motion will be more confined, but fuch a Joint will be lefs expofed to Luxations.

 Mufcles.

Muscles. Immoveable Bones are more firmly connected by them; of which the Conjunction of the Os Sacrum and Ossa innominata is an Example. They afford a Socket for moveable Bones to play in, as we likewise see in the Scapula with the Humerus.

The EXTERNAL MEMBRANES of the BONES.

The Periosteum, in general, is a thin and strong Membrane or membranous Expansion, not equally thick through its whole Extent, more or less transparent, of a very close Texture, endued with extreme Sense, composed of several particular Lamellæ of Fibres, differently disposed, and mixed with a great Number of small Vessels and nervous Filaments.

The Bones in their natural State, are, for the most part, covered exteriorly by this Membrane, generally named Periosteum, which is extended even over the Cartilages and Ligaments, as well as over the Bones; but where it covers the Cartilages, it is termed Perichondrium, and where it covers the Ligaments, Peridesmium. The Portion which covers the Cartilages, and incloses the Ligaments, is provided with not many sanguiferous Vessels and nervous Filaments, therefore is not so sensible as that which invelopes immediately the Bones.

This Membrane does not immediately surround those Portions of Bones which are covered by Cartilages, nor those in which Ligaments and Tendons are inserted. Neither does it cover those Portions of Cartilages which are exposed to Friction, as in the moveable Articulations, Canals, &c. Lastly, It does not cover those Portions of the Teeth which lie out of the Sockets and Gums.

The interior Lamina of the fibrous Texture of the Periosteum, or that which immediately adheres

heres to the Surface of the Bones, is fixed thereto by an infinite Number of fmall fibrous Extremities brought from all the Laminæ, which enter the Pores of the Bones. Thefe Extremities are accompanied by capillary Veffels and nervous Filaments, which, having run for fome fpace between the different Laminæ of the Periofteum, perforate the innermoft at the Orifices of the Pores of the Bones.

The Periofteum is of different Thickneffes; but this Difference does not appear near fo much on the external Surface as on the internal, which is marked in many Places with Impreffions, owing to the Sulci, Depreffions, Lines, and Inequalities of the Surface of the Bones.

When we attempt to tear the Periofteum off the Bones, a Multitude of Filaments appear between this Membrane and the Bone, as coming from the internal Part of the Bone. After a fuccefsful Injection of the Arteries with a red Liquor, numerous Veffels are not only feen on the Periofteum, but moft of the Fibres, going from the Membrane to the Bone, fhew themfelves to be Veffels entering the injected Liquor in them; and, when they are broken by tearing off the Periofteum, the Surface of the Bone is almoft covered with red Points.

The Veins correfponding to thefe Arteries, are fometimes to be feen in Subjects that die, with their Veffels full of Blood, through fuch numerous Ramifications as cannot be demonftrated: As of the Arteries; the Veins are incapable of allowing an injected Liquor to pafs from their Trunks into their minute Branches.

The great Senfibility of the Periofteum in the deep-feated Species of Paronychia in Exoftofes, Nodi, Tophi, and Gummata, from a Lues Venerea, is a fufficient Proof that it is well provided with Nerves, though they are too fmall to be

 traced

traced by the Scalper; therefore we cannot well determine whether they are fent along with the Arteries in the common Way, or derived from the tendinous Fibres of the Mufcles, expanded on the Periftoeum.

Some Authors endeavour to prove the internal Fibres of the Periftoeum to be derived from the Dura Mater, as they fay, fince the Pericranium is a Production or Continuation of the Dura Mater, which paffes between the Sutures; and there are Mufcles on the Head, as well as in other Parts, which might furnifh a Periofteum; 'tis needlefs to affign another Origin to this Membrane. Even Havers adds further, to fuftain this Hypothefis, that he can demonftrate the Periofteum to be continued from one Bone to another, by perfecuting and raifing it from the Ligaments which cover the Articulation. Alfo Dr. Nesbitt fays the fame in his Ofteogeny, but it is not demonftrable from the Bones of an Infant. All thefe Arguments are to fupport that Doctrine, which prevailed formerly, that all Membranes proceeded from the Dura Mater. Others imagined, that the Periofteum limits the Growing of the Bones.

The general Ufe of the Periofteum is to fupport that admirable Texture of an Infinity of capillary Veffels, by which the Bones and all the Parts belonging to them are nourifhed. It likewife fuftains a great Number of nervous Filaments, by which Senfation is communicated, not only to this, and to the internal Membrane of the Bones, but even in fome degree to fome Portions of the offeous Subftance. From the vafcular Texture of Bones, they are fubject to Obftruction, Ecchymofes, Ulcers, Gangrenes, and a Variety of Caries.

The Solidity of Bones increafes by Age. This is the Reafon why the Bones of old Subjects are more friable than thofe of young ones.

The

The Mucilaginous Glands.

In all the moveable Articulations, especially of those Persons who end their Lives by sudden or violent Deaths, we find a viscid Liquor, in some measure resembling a liquid Mucilage, or the White of an Egg well beat, which is commonly called Synovia, a Name given at first to the Disease which affected this Part.

This Liquor is contained in the Articulations and ligamentary Capsulæ, which hinder it from running out. It is furnished chiefly by small Bundles of Glands more or less flat, contained in the same Capsulæ, and known by the Name of Mucilaginous Glands; these being the Organs through which this Mucilage is conveyed from the Blood. It may likewise partly transude through the Pores of the internal Surface of the capsular Ligaments; and partly be made up of an unctuous Matter pressed from the pingueous Substances lying near the Glands, by the Motion and Friction of the articulated Bones.

These Glands are more or less of a red Colour, and of a very singular Structure, resembling small floating Fringes of different Thicknesses, made up of folliculous or vesicular Grains, and furnished with a great Number of Vessels running in very different Directions. In some Places they appear like distinct Grains immoveably fixed. They are proportioned to the Bones and Joints, and lodged so as to be secured from violent Frictions, chiefly near the Edges of the Capsulæ, or in particular Cavities contrived on purpose to receive them.

The Liquor continually furnished by these Glands, mixed with that which transudes through the Pores of the Capsulæ, and perhaps with that which comes from the fat Molecules, is diffused between the articulated Bones, and its Use is to facilitate their Motions, to prevent them from

bruising each other, and to keep their Cartilages from drying or wearing out.

In the particular Description of each Articulation, we shall explain the Differences of mucilaginous Glands, with respect to their Conformation, Size, Number, and Situation.

The Liquor, which principally serves to moisten the Ligaments and Cartilages of the Articulations, is supplied by these mucilaginous Glands, which are commonly situated in the Joint, after such a Manner as to be gently pressed, but not destroyed by its Motion. By this means, when there is the greatest Necessity for this Liquor, that is, when the most frequent Motions are performed, the greatest Quantity of it must be separated. These Glands are soft and pappy, but not friable: They are mostly of the conglomerate Kind, or a great Number of small Glandules are wrapt up in one common Membrane. Their excretory Ducts are long, and hang loose, like so many Fringes, within the Articulation; which, by its Motion and Pressure, prevents Obstructions in the Body of the Gland, or its Excretories, and promotes the Return of this Liquor, when fit to be taken up by the absorbent Vessels, which must be in the Joints, as well as in the other Cavities of the Body; and at the same time, the Pressure on the excretory Ducts hinders a superfluous Secretion, while the fimbriated Disposition of these Excretories does not allow any of the secreted Liquor to be retrograded by these Canals towards the Glands, as COWPER * has justly remarked.

Besides these conglomerate Glands, we meet sometimes with small simple Folliculi, observed by MORGAGNI †, that are full of Liquor.

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* Anatom. Explicat. Tab. 79. litt. E. E.

† Adversat. 2. Animad. 23.

Upon

Upon pressing any of these Glands with the Finger, one can squeeze out of their Excretories a mucilaginous Liquor, which somewhat resembles the White of an Egg or Serum, but is manifestly of a saltish Taste. It does not coagulate by Heat, as the Serum does; but turns first thinner, and when evaporated, leaves only a thin salt Film. Different Salts have much the same Effect on it, as on the other Juices of our Body; for Acids coagulate it, and Alkalies attenuate it. The Quantity of this Mucilage, constantly supplied, must be very considerable, since we see what a plentiful Discharge of Synovia follows a Wound or Ulcer of any Joint, of which the mucilaginous Liquor is considerably troublesome.

The Vessels which supply Liquors for making the Secretion of this Mucilage, and the Veins which return the Blood remaining after the Secretion, are to be seen without any Preparation, but after a tolerable Injection of the Arteries, the Glands are covered with them.

In a sound State we are not conscious of any Sensibility in those Glands; but in some Cases which I have seen, when they inflame and suppurate, the most racking Pain is felt in them: A Melancholly, though a sure Proof that they have Nerves.

These mucilaginous Glands are commonly lodged in a cellular Substance; which is also to be observed in other Parts of the Capsula, formed by the Ligaments of the Articulation, and contains a pingueous Matter, that must necessarily be attenuated, and forced through the including Membranes into the Cavity of the Joint, by the Pressure which it suffers from the moving Bones.

If then the Oil is conveyed from this cellular Substance, and if the attenuated Marrow passes from the Cancelli of the Bones by the large Pores

near

near their Extremities, or in their Cavities, and transfudes through the Cartilages into the Articulations; which it may, when assisted by the constant Heat and Action of the Body, more easily do, than when it escapes through the compact Substance of the Bones in a Skeleton: If, I say, this Oil is sent to a Joint, and incorporated with the Mucilage, and with the fine Lymph that is constantly ouzing out at the Extremites of the small Arteries, distributed to the Ligaments, one of the fittest Liniments imaginable must be produced; for the Mucus, diluted by the Lymph, contributes greatly to its Lubricity, and the Oil preserves it from hardening. How well such a Mixture serves the Purpose it is designed for, BOYLE * tells us, he experienced in working the Air Pump; for the Sucker could be moved with much less Force after being moistened with Water and Oil, than when he used either one or other of these Liquors. And I believe every one at first View will allow the diluted Mucilage to be much preferable to simple Water. The Synovia, as this Liquor is composed of Oil and Mucilage, will therefore, while in a sound State, effectually preserve all the Parts concerned in the Articulations soft and flexible, and will make them slide easily on each other, by which their mutual Detrition and Over-heating may be prevented; in the Manner daily practised in Coach and Cart-wheels, by lubricating them with Grease and Tar.

After the Liquor of the Articulations becomes too thin and unserviceable, by being constantly spounded and rubbed between the moving Bones, it is reassumed into the Mass of Blood by the absorbent Vessels.

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* Physico-mechanic. Experim.

When

When the Synovia is not rubbed betwixt the Bones, it inspissates; and sometimes when the Head of a Bone has been long out of its Cavity, this Liquor fills up the Place of the Bone, and hinders its Reduction; or if a Joint continues long unmoved, the Synovia cements the Bones, and occasions a true Anchylosis. AMBROSE PARE * says, he has frequently seen such Cases, and HILDANUS † gives a particular Example of it. If the Synovia becomes too acrid, it erodes the Cartilages and Bones, as frequently happens to those who labour under the Lues Venerea, Scurvy, Scrophulæ, or Spina Ventosa. If this Liquor is separated into too small a Quantity, the Joint, as GALEN ‡ remarks, becomes stiff; and when with Difficulty it is moved, a crackling Noise is heard, as People advanced in Years frequently experience. This Sort of Disease AQUAPENDENTE § very accurately describes, and rationally accounts for. If the Mucilage and Lymph are deposited in too great a Quantity, and the absorbent Vessels do not perform their Office sufficiently, they may occasion a Dropsy of the Joints, which HILDANUS ‖ has at large treated of. From this same Cause also the Ligaments are often so much relaxed, as to make the Conjunction of the Bones very weak: Thence arise the Luxations from an internal Cause, which are easily reduced, but difficulty cured. Frequently when such a superfluous Quantity of this Liquor is pent up, it becomes very acrid, and occasions a great Train of bad Symptoms; such as Swelling and Pain of the Joints, long sinuous Ulcers and Fistulæ, rotten Bones, Immobility of the Joints, Macor, and Atro-

* Surgery, Book XIII. Chap. 18. † Observat. Cent. III. Obs. 77.
‡ De Usu Part. Lib. XII. Cap. 2. § De Articul. Part. Utilitat. Pars III. ‖ De Ichore & Meliceria acri Celsi.

phia of the whole Body, hectic Fevers, &c. HIPPOCRATES * defcribes accurately moft of thefe Symptoms from the difeafed Mucus of the Joints; and HILDANUS † gives the Hiftories of many People labouring under them.

OBSERVATIONS.

Notwithftanding what Dr. HALLAR endeavours to prove in his Differtations, concerning the Senfibility and Irritability of the Parts of the Animal, the ingenious Dr. WHYTT, Profeffor of Medicine in the Univerfity of Edinburgh, has, I think, fufficiently proved in his Phyfiological Effays, that the learned Profeffor HALLAR has not well confidered what he advances on this Subject.

When the cellular Subftance, connecting the Periofteum to the furrounding Parts, is deftroyed; thefe Parts are fixed to that Membrane, and loofe the fliding Motion they had upon it; as we fee daily in Iffues, or any other tedious Suppurations near a Bone. When the Veffels which go from the Periofteum to the Bones are lacerated or eroded, a Collection of their Liquids is made between the Membrane and Bone, which produces a fordid Ulcer or rotten Bone. This often is the Cafe after Fractures of the Bones, and Inflammations of the Periofteum, or after the Small Pox, Meazles, fpotted Fevers, and Eryfipelas. Do not the Diforders of the Periofteum, coming along with, or foon after the cutaneous Difeafes, incidate a Similarity of Structure in the Periofteum and Skin?

* De locis in homine & de articul.
† De & Meliceira Ichoreacri Celfi.

LEC-

LECTURE III.

Diviſion of the BONES.

IT is proper we ſhould conſider in general the external Conformation of the Bones, their Connection and Uſes; I mean all that may be obſerved about them, while they remain intire, ſuch as their Size and Figure of their external Parts.

Some Bones are large, as the Humerus Femur, thoſe of the Leg, Oſſa Innominata, ſome middle ſized, as many Bones of the Head, the Vertebræ, Ribs, Metacarpus, and Metatarſus; others, in fine, are ſmall, as thoſe of the Carpus, Fingers, Toes, and Teeth.

Some Bones are long, as the Humerus, Ribs, &c. ſome are broad, as the Parietal Bones, the Scapula, and Oſſa innominata; and there are others in which the three Dimenſions of Length, Breadth, and Thickneſs do not differ much from each other, as the Vertebræ, Bones of the Carpus and Patella; ſome others are ſymmetrical, a certain reciprocal Regularity being obſerved between their different Sides; as the Frontal, Occipital, Sphenoïdal, Cribroſum, and Vomer Bones; the inferior Maxilla, Os Hyoïdes, Vertebræ, Sternum, Os Sacrum, and Coccyx: Theſe Bones are ſingle, being placed in that Space which diſtinguiſhes the right Side of the Body from the left.

The

The reft of the Bones are double, or in Pairs, whereof one is fituated on each Side of the Body. Thefe, taken fingly, have not that Symmetry already mentioned, but when annected to the correfponding Bones on the other Side, they form a regular Figure, as we fee in the Parietal Humerus and Femur Bones.

In regard to Extent and Figure, the long Bones are divided into a middle Part and Extremities; the broad Bones into Side, Angles, Bafes, and Edges: Thefe Edges are fometimes termed Coftæ, fometimes Criftæ, and they are fometimes fubdivided in two lateral Parts, and called Labia. With regard to Situation, Bones are divided into the fuperior, middle, inferior, anterior, pofterior, and lateral Parts, and thefe again into external and internal, as Occafion requires.

But in order to determine thefe feveral Parts exactly, the natural Situation thereof ought to be well obferved; in doing which, I fhall always confider the Subject in an erect Pofture; and indeed it would be proper that this Rule fhould be extended to all the other Parts of the Body, that the Language of Anatomy might be perfectly uniform; and that one Perfon, for Inftance, might no longer call that the fuperior Part, which another calls the anterior, fuch Confufion may be of very bad Confequence in Reports delivered to Judges. We muft likewife obferve, that the Words internal and external, befides their ordinary and natural Signification, are taken in feveral other Senfes by Anatomifts.

In fuch Cafes I fhall call that Part internal which lies neareft a Plane, which being fuppofed to pafs from the Crown of the Head down between the two Heels, divides the Body into the right and left Sides; and the Part that is fartheft from fuch a Plane, I fhall name external; thus the Edge of the

the Orbit, near the Nose, is internal, that near the Temples, external.

I shall observe this Rule likewise in the Parts which compose the Extremities: Thus I shall call that Side of the Tibia external, which is next the Fibula of the same Leg, and that internal which is next the other Leg.

The Bones of several Parts of the Body differ from one another in their Sizes, Cavities, Qualities, Figures, and Uses; as will appear when we come to a particular Consideration of them; but, I think, before we enter on that Subject, some Observations on them will not be amiss:

1. The Bone itself. 2. Its Cavities. 3. Its Conjunctions or Articulations with the other Bones. 4. Its Uses in regard to the Bone itself.

We are to observe,

1. The Diaphysis, or the principal Portion of Bones, which is the Middle, and in young Subjects, the first Part that indurates, and is, as it were, a Basis or Foundation of the rest.

2. An Apophysis is an Elevation or Excrescence from the Body of the Bone, of which it is a true continuous Part, as a Branch of a Tree. The Apophyses assume different Names according to their Figures. Caput, or Head, is a round Eminence at the Extremity of the Bone, and the Part immediately under it is called Cervix or Neck Condylus, is an Eminence not exactly round, but a little flat: such are posterior Apophyses of the inferior Maxilla, &c.

A Protuberosity, or Tuberosity, is an Eminence of a considerable Extent; but when the Surface is unequal and rough, such as that of the Calcaneum or Heel Bones, &c. Some other Precesses or Apophyses, take their Names from somewhat the Likeness they bear. Styloïd, because it is sharp; Mastoïd, or Mammellaris, like the Nipples of

a Woman's Breaft; Coracoïd, refembling a Crow's Bill; Clinoïd, like a Bed's Foot. Such are the Apophyfes of the Sella Tarcia; Acronium or Anchoroïdes, like an Anchor; Crifta or Creft; Coronoïd, the End a little pointed; Pterygoïd, like a Bat's Wing; when they are like a Tooth, Odontoïd or Dentiformis; Spinofa like Spina, as the Vertebræ of the Back; Recta, when the Proceffes or Apophyfes are ftrait, oblique, tranfverfal, &c. None of thefe Eminencies derive their Names from their Ufe, except thofe of the fuperior Part of the Femur, which we call Trochanters, which fignifies to turn.

The Inequalities, obfervable on the Surface of the Bones, ferve principally for the better Security of the Infertion of the Mufcles.

The principal Ufes of the Apophyfes of the Bone are, Firft, for the better making Articulations, whether they are intended to have Motion, or to be fixed: Secondly, To afford a proper and firm Place of Origination and Infertion for the Mufcles; and, Thirdly, To defend the other Parts.

An Epiphyfis is an offeous Subftance, or, as it were, a leffer Bone, affixed to a larger or principal Bone, by the Intervention of a Cartilage. In young Subjects, thefe Epiphyfes are not continuous to the principal Bone, but are only connected by the intermediate Cartilage; and hence they are called Appendages to the Bones.

The principal Things to be obferved of thefe Epiphyfes are: 1ft, That they are all cartilaginous in Infants; and though they afterwards gradually grow harder, yet they never arrive at the true Denfity of a Bone, but are always lax and fpongy. 2dly, That moft of them degenerate into Apophyfes in Adults. 3dly, That they do not grow along the plain Surface of the Bone, but inequally by a natural Ingrefs with the Body of it.

4thly,

4thly, That their Nature and Conjunctions are much more obvious in younger than in older Subjects. 5thly, That the Body of the principal Bone itself is spongy and tender about the Place of the Conjunction.

1. Wherever we mention any Parts being cartilaginous, or their being still separable from the other Parts of the Bone to which they belong, we would be understood to hint, that about seven or eight Years of Age, such Parts are ossified and united to their proper Bones, unless when it is said that they are afterwards formed into Epiphyses.

2. Such as become Epiphyses are generally ossified at seven or eight Years of Age, but being for the most Part moistened by Synovia, their external Surface is still somewhat cartilaginous, and they are not yet united to their Bones.

3. At eighteen or twenty Years of Age, the Epiphyses are entirely ossified, and have blended their Fibres so with the Body of the Bone, as to make them inseparable without Violence.

The Knowledge of this Part of the Osteogeny, is very necessary to prevent dangerous Mistakes in the Cure of several Diseases: As for Example, without this Knowledge, the Separation of an Epiphysis might be mistaken for a Fracture or Luxation. The Interstice of two Parts of a Bone not yet joined might be be judged to be a Fissure. A Diastasis, or other violent Separation of such disjoined Pieces of a Bone, might be thought a great Fracture. The Protrusion of one Piece over any other, might be mistaken for an Excrescence or Exostosis. Such Errors about the Nature of a Disease would give one very different Indications of Cure, from what one would have, if we really understood the Patient's Case. And very often the Knowledge of the different Inequalities on the Surfaces of

Bones must direct us in the Execution of what is proper to be done to cure several Diseases of Bones *.

The Use of the Epiphyses is very different in Infants and Adults.

In Adults, they seem to serve to the Bones, which contain large Quantities of Marrow, 1st, By way of Covering, that this soft Matter may not run out. 2dly, They are of Service to the Articulations, rendering the Motions more easy, as well as more determinate. 3ldy, They make the whole Bone lighter than it would be, if their Place was supplied by absolute osseous Matter, as they are much more spongy. 4thly, They greatly increase the Power of the Muscles about the Tendons, by means of their Prominencies. 5thly, They add greatly to the Size of the Places destined for receiving the Insertions of the Muscles. 6thly, They give a firmer Cohesion to the Ligaments, which serve in the Articulations, and allow an Ingress to the sanguiferous Vessels.

The Uses of the Epiphyses in Infants are, 1st, That by means of their yielding Softness, they may give way to the Compression in the Uterus, and suffer the whole Bulk to be more folded together, than otherwise it could, so that it may lie in a smaller Compass. 2dly, That they may give way to the Elongation and Growth of the Bones; that as the Body grows, they may be proportionably extended as necessary. 3dly, Likewise, that they may prevent the frequent Fractures which would

* We observe, that some Epiphyses have Apophyses belonging to them, as the inferior Extremity of the Tibia, and some Apophyses have Epiphyses annexed to them; as Trochanter Major, and the Head of the Femur is a true Epiphysis of that which is called Cervix, except the Bodies of the Vertebræ, or Ossa innominata; which Ossification does not begin at the middle Portion, which is the principal Part in an Adult.

would otherwife unavoidably happen to Children from their Falls.

The Cavities met with on the external Surface of Bones are of two kinds, fome of which are deftined for the Articulations, whilft others are of no Ufe for that Purpofe; the firft are either large or fmall; the large called Cotyloïd or Acetabulum, fuch as the Cavities of the Offa innomminata. The fmall called Glenoïd, fuch as Cavities of the Scapula or Omoplata; they are deeper in frefh Bones, than in fuch as have been dried, becaufe of the cartilaginous Eminencies intended by Nature for the Affiftance of the Articulation, being taken away in thefe. Thefe Cavities contain a mucilaginous Liquor, and the Ligaments of the Articulations, probably alfo from the Marrow itfelf. This is deftined for the lubricating the Bones, and facilitating their Motions on one another.

The external Cavities have received various Names, fomewhat liker their Figures. 1ft, Foffa is a Cavity whofe Entrance is generally larger than its Bottom; fuch are thofe of the coronal Bone. A Sinus, on the contrary, is larger at its Bottom than at its Entrance, as is obfervable in the frontal and maxillary Sinufes, &c.

A Sinuofity is a Cavity, more extenfive in its Length than in Breadth; fuch is obfervable in the fuperior Part of the Humerus, &c.

A Sciffure differs from a Sinuofity in this; that it is narrower, and only lodges Veffels, fuch as thofe of theRibs, &c. whereas a Sinuofity receives only Tendons, and is lined with a Cartilage.

A Sulcus is a Cavity in form of a Crefcent, and is generally found in thofe Parts through which Apertures perforate; fuch are thofe of the Vertebræ.

Foramina or Holes, are Cavities whofe Entrances are very near their other Extremities; fuch are thofe in the Bafis of the Cranium.

 A Canal

A Canal is a Cavity, whoſe Extremity is at ſome Diſtance from its Entrance; ſuch are the Maxillary Canals, &c.

A Fiſſure is a longitudinal and narrow Cavity, having its Entrance near its other Extremity; ſuch are the Fiſſures of the ſphenoïd Bone, &c.

Theſe different Cavities are for the moſt part formed in the ſame Bone, tho' ſome of them are produced by the Meeting or Concurrence of ſeveral Bones, which has laid a Foundation for diſtinguiſhing them into proper and common.

The proper are thoſe found in the ſame Bone; ſuch are the Foſſæ, obſervable in the internal Surface of the Cranium, which are for that reaſon called Coronal. The others called common, are the Foſſæ Orbitariæ, the Foramina Lacerata, &c.

Beſides all theſe different Cavities, we alſo obſerve on the Surfaces of the Bones, ſeveral Sulcuſes or Furrows, which terminate in ſo many Holes of indefinite Smallneſs; we there alſo obſerve the Orifices of ſeveral Canals, which penetrate into the internal Subſtance of the Bones.

The Regions of the Bones are diſtinguiſhed with reſpect to their Extent, their Situation, and other Circumſtances.

The long Bones are diſtinguiſhed into the ſuperior, the middle, and inferior Parts; and the broad Bones into their external and internal Surfaces, &c. obſerving always to have Regard to the natural Situation of the Body, that is, to ſuppoſe the Skeleton in an upright Poſition.

LECTURE IV.

SYNOSTEOGRAPHY: Or, the Connection of the BONES by means of their natural LIGAMENTS.

THE Articulations are diſtinguiſhed into two Kinds; the one permits a Motion in their articulated Pieces, and is called Diarthroſis; the other permits of no Motion, and is named Synarthroſis.

The Diarthroſis is of two Kinds; the one permits a ſenſible and manifeſt Motion, and the other only ſuch as is obſcure and imperceptible. The manifeſt Diarthroſis is performed with a free Motion, in various Directions, as is obſervable in the articulating of the Humerus with the Omoplata; in that of the Femur with the Os innominatum, &c.

Or it is only performed with a Motion confined to two Directions, as in the articulating of the Cubitus with the Humerus, in that of the Phalanges of the Fingers with each other, &c.

This Articulation is formed by the Reception of an Eminence into a Cavity, as is obſervable in the joining of the Humerus with the Scapula; of the Femur with the Os innominatum, &c. This Species of Articulation is more or leſs deep, which

has given Occafion to the Antients, to diftinguifh it into two Species; the deepeft they called Enarthrofis, and the moft fuperficial Arthrodia.

Ginglymus is an Articulation, whofe Motions are confined to certain Directions. This kind of Articulation with Motion, in which two Bones are connected by one or more Heads received into as many Cavities; and the Motion arifing from this confined to two Directions only.

A Ginglymus in general is divided into two Sorts; the one perfect, and the other imperfect; the perfect is that formed by feveral Heads and feveral Cavities, and in which the two Bones receive one another mutually, as is obfervable in the joining of the Tibia with the Aftragalus; and in the Phalanges of the Fingers with each other, &c.

A Ginglymus is faid to be imperfect, when the joining of the Bones is only formed by two Eminencies, received into two Cavities, as is obfervable in the Articulation of the occipital with the firft cervical Vertebra; and the Vertebræ with each other by their oblique Apophyfes, in that of the Femur with the Tibia, &c. Or when a connecting of two Bones is only formed by the Reception of one Eminence into one Cavity, as is obfervable in the Articulation of the firft with the fecond Vertebræ by means of its odontoïd Apophyfis, or in that of the Ulna with the Radius, as well in the fuperior as in the inferior Part of thefe Bones.

The obfcure Diarthrofis, or that which permits but of very imperceptible Motion, is principally obferved in the Bones of the Carpus, and moft of thofe in the Tarfus.

The Synarthrofis is that Species of Articulation by which the Bones are kept together in fuch a manner as to remain in a firm Situation: It is performed two different Ways; the firft is by

Inden-

Indentation, and the fecond in the fame Manner as a Nail or Pin fixed in Wood. The firft may be divided into two Kinds, one deep and the other fhallow: The deep Indentation is obferved in broad Bones, and is by the Fathers of Anatomy called Suture, which is evidently feen in the joining of the Bones in the Cranium. The fhallow Indentation is that obferved in the Bones, which are joined by more extenfive Surfaces, and whofe external Connecting does not appear denticulated. This is what the Antients have called * Harmony, and for an Example of this Kind they have mentioned the Bones of the Face.

The fecond Species of Synarthrofis is called Gomphofis: It may be compared to a Nail, or a Peg received into a Hole, fuch is the Reception of the Teeth into the Cavities of the Maxilla, Alveoli, or Sockets.

All the Places which compofe the Skeleton, are naturally united with each other; and this Union is by the Antients called Symphyfis, which is diftinguifhed into two Kinds, one with and the other without Means.

A Symphyfis is faid to be without Means, when the affembled Bones are maintained in that State by themfelves, that is to fay, merely by their own Conformation: Such are the Parietals, which mutually fupport each other, by the peculiar Structure of their Teeth; that is to fay, of the Eminences and Cavities, which conftitute this Suture; likewife of the other Bones of the Cranium, &c.

* There is no fuch Thing as Harmonia or Articulation, in which the Bones are joined by a bare Touch or ftrait Line, and thofe of the Superior Maxilla, which were pointed out for an Example, have all of them, like thofe of the Cranium, Cavities, which crofs and mutually receive one another like Saw Teeth.

Some refer to the Symphyfis without Means, the Union of the two Pieces, which compofe the inferior maxillary Bone in young Children; but it ought to be obferved, that this Union is only a Confequence of the Offification of thefe two Pieces.

The fecond Species of Symphyfis is by Means, which unites, faftens, or maintains the Collection of the Bones, by the Affiftance of Cartilages, Ligaments, and Mufcles; and this is what the Ancients have called Synchondrofis, Synneurofis, and Syffarcofis.

The Synneurofis, which is the faftening of Bones by Ligaments, is principally met with in all the moveable Articulations. It alfo fortifies the Synchondrofis, as is obfervable in the articulating of the Vertebræ by their Bodies.

The Synchondrofis, which is the faftening of the Bones, by means of Cartilages, is principally obfervable in the articulating of the Vertebræ by their Bodies, in that of the Offa Pubis, with each other, &c.

The Syffarcofis is when the Bones are united by means of Mufcles, fuch as is the Junction of the Scapula with the Ribs.

The Syndefmus happens when the Bones are joined by the Help of a Ligament, fuch as thofe of the Carpus, Tarfus, Hyoïdes, &c.

The Syntefmus is when the Junction is made by a Tendon, fuch as is the Head of the Femur in the Cavity of the Ifchium.

The Synymenfis is when the Union is affected by a Membrane, as 'tis with moft Parts of the Articulations.

The Manner of the Junction of the Bones, in order to facilitate their Motion, is called Articulation.

LEC-

LECTURE V.

Osteography: Or, the Deſcription of the Bones in particular.

THE Cranium is formed by an Aſſemblage of eight Bones, each compoſed of two Laminæ or Tables, one of which is external and the other internal. This latter is called Vitrea, becauſe it is thinner, and friable as Glaſs. Between theſe two Tables, there is a ſpongy Subſtance called Diploë * or Meditullium, which is not of the ſame Thickneſs through the whole Cranium; for in ſome Parts it runs but thin, and in others it is not to be met with at all.

The Bones of the Cranium are divided into two Claſſes, proper and common: The proper are, according to Authors, ſix; but it appears to me there are but three, viz. Os Occipitis, and Oſſa Bregmatis, and all the reſt are common with thoſe of the Face.

* The Diploë is much of the ſame Texture as the Cancelli of the other Bones, and contains likewiſe a medullary Juice, with numerous Ramifications of ſanguinous Veſſels ſpread on them; but ſometimes in old Crania the Diploë is ſo obliterated, that ſcarce any Veſtiges are left. Often a Collection of Matter is formed in the Diploë, either from internal or external Cauſes; wherefore Surgeons are not to truſt the Bleeding of the Diploë in performing the Operation of the Trepan, but ought to obſerve alſo the Sinuſes and Sulci made by the Pulſation of the Arteries of the Dura Mater in the Fœtus State.

As the Os Sphenoïdes is the Basis of all the Bones of the Cranium, and most of those of the Face, I think it proper to deviate from the common Rule of Anatomists, and begin with the Description of this Bone, and proceed with those which appear the most contiguous in their Situation.

Os Sphenoïdes, or rather Basilare (because its Situation is in the Middle of the Cranium, and it is the Basis of all the Bones of the Cranium, and almost of those of the Face) is of a very irregular Figure, and somewhat resembling that of a Bat, with its Wings extended. This Bone is divided into a Body, and two flat Apophyses called Sphenoïd.

We are likewise to distinguish it, in two Surfaces, the one external, and the other internal. The external has six Apophyses, two Foramina or Holes, two Sinuses, and six Scissures. Of these, the first two are Pterygoïd, so named from their Likeness to a Bat's Wings; they have each a pretty long Sinus, and at their inferior Extremity they have each a small Hamus, somewhat like an Apophysis. The third and fourth make the internal and inferior Part of the Orbit; and the fifth is a little Process, like the Crista Galli, in its anterior Part, which is received in a Cavity at the further End of the Vomer. In its internal Side, it has four Clynoïd Apophyses, which form a Cavity in the Middle of this Bone, called Sella Equina, or Turcica.

Betwixt the two Tables of this Bone under the the Sella Turcica there is a Sinus, sometimes divided into two in the Middle, which opens by two Foramina into the Cavity of the Nostrils, and sometimes is totally wanting*.

* This Bone in young Subjects is divided into two or three; but in Adults it is only one Bone, called the Cullender by the Antients; because they believe the Phlegm passed through the Holes in this Bone into the Mouth.

Os

Os Frontis, or Coronal, (fo called by the Ancients from placing their Laureat Crowns on the Forehead Bone*) is fituated in the anterior Part of the Cranium, and forms the fuperior Part of the Face, and of the Orbits. This Bone has two surfaces, one external and one internal. In the interior Part of its external Surface are five Apophyfes, four of which are called by fome Anatomifts Angles of the Eyes, and by others Orbitaries; and diftinguifhed them into internal and external. The fifth, named Nafal, ferves as a Support to the Bones of the Nofe. In this Place alfo are two Depreffions which make Part of the Orbits, and of the fuperior Rim of the Orbits: There are two Foramina, termed fuperciliary, which are oftentimes no more than Sciffures; at the inferior and middle Part of the Coronal, there is a Canal to lodge the Os Ethmoïdes, and at the connecting of thefe two Bones, (efpecially near the Orbits) we find a Foramen on each Side, and fometimes two, which are called the internal Orbitary Foramina. In the internal Surface of the Coronal, we are to confider two Depreffions alfo named Coronal, a Spine, a Sciffure, a Foramen called Blind or Spinal, and feveral fuperficial Depreffions, which correfpond to the Circumvolutions of the Cerebrum.

In the middle and inferior Part of this Bone, we find the two Cavities, called the frontal or fuperfiliary † Sinufes, which run through the whole Thicknefs of the Bone, and communicate with the Nofe.

In fome Subjects we have but one of thefe Sinufes, and in others they are both wanting; and rarely found in Children.

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* This Bone is always divided into two in Infants, and fometimes remains fo in Adults.

† Thefe Sinufes and the Spine in this Bone, to which the Dura Mater adheres, make it very dangerous, if not impracticable to apply the Trephine or Trepan, on the middle and inferior Part of this Bone.

Os Ethmoïdes, or Cribriform, or Cribrosum, so called because it is perforated like a Sieve. In this Bone we observe its Situation in the Base of the Coronal Bone, and its Extension through the Nostrils and Orbits; its four Apophyses, the Crista Galli, and the two Ossa Spongosa Superiora, which are called also by some Anatomists Turbinatæ, to which Morgagni has added two other smaller ones, the Cribrose, Carverose, Papyraceous or Plane Parts, under the various little Sinuses. Some take these spongy Parts of the ethmoïd Bone for peculiar Bones, but they are always continuous in Adults. In the external Parts, near the Orbit, these Cellules are confined by the Os Unguis, and a very smooth Lamina, of which the Antients made a particular Bone they called Os Planum. In the internal Surface of the ethmoïd Bone, we observe a Lamina called Cribriforme. The Apertures found in this Bone retain the Name of Olfactory, from those Nerves which pass thro' them *.

Os Temporum (so called because the Hairs first become grey on these Bones) are generally divided into two Parts; one superior, called Squammous or scaly, and another inferior, called Petrous or stony. These two Parts are easily separated from each other in young Subjects, but they become so firmly united afterwards, that it is impossible to divide them in Adults; in these we are to regard the Situation and the Figure which are very irregular; the Connection and the Substance, which are as their Names express, their four Apophyses; and are, the Ingala or Zygomatic; the Mastoïd, the Styloïd, and Petrosus; the Place where the inferior Max-

* Cheselden says, that he could never discover these nervous Filaments. I believe he was the only Author among the Moderns.

illa is articulated; the Meatus Auditorius, or Auditory Passage; and the Sigmoid Fossæ: Here the lateral Sinuses of the Dura Mater are placed. In the temporal Bone, and particularly in its petroseous Part, are to be observed the Cavity of the Drum, and the Officulæ Auditoriæ, or the little Bones that serve to the Organs of Hearing, which are commonly four in Number, viz. The first is named Malleus, or Hammer; in this we are to observe the Head, the Neck, and the Handle, which is joined to the Membrane of the Tympanum or Drum; its two Apophyses are also to be observed; these serve for the Insertion of the external Muscle of the Malleus.

The second is the Incus or Anvil, in which we are to observe the Body of the Bone, and its Fovea or Hollow, serving for its Articulation with the Malleus, and its two Crura or Legs; to the longer of which there is joined another Bone, called Strapes or Stirrup: In this Bone we are to observe the Head, which is joined to the longer Leg of the Incus; its Basis, which stands on the Fenestra Ovalis of the Labyrinth of the Ear, and its lateral Parts, which have their internal Surface furrowed. What is generally called the fourth Bone of the Ear is placed between the Incus and the Strapes, and is named Os Orbiculare, or Lenticular Bone, and is reckoned the smallest Bone of the whole Body. But this is not truly a distinct or separate Bone, but is merely an Epiphysis of the longer Leg of the Incus.

Of the Foramina, the first is the Fenestra Ovalis, on which the Base of the Strapes stands; near this is the second, which is called the Fenestra Rotunda: This leads to the Cochlea, the other to the Vestibula of the Ear. The third Foramen, by means of a Canal, is carried to the Mouth: This

is called the Euftachian Duct or * Tube, from the Name of its Difcoverer. The fourth Foramen opens into the Cellules of the Maftoïd Procefs. All thefe are for the Ufe of Hearing. The remaining Part of the Ear will be treated on when we fpeak of the Organ of Hearing.

Ossa Parietalia, or Bregmatis Sincipitis, or Bones ferving as Walls to the Encephalon. In thefe we are to obferve the Situation and Figure, which are nearly a Square, their Size and Connection with the other Bones of the Cranium, and their Thicknefs. Their external Surfaces are likewife to be examined; their internal Surfaces, in which there are Furrows reprefenting Shrubs, or Fig-leaves, are formed by Arteries of the Dura Mater, when yet the Bones are foft; and befides thefe there are Foveæ or hollow Places: And finally, we are to obferve the Place called the Bregma, and, in Infants, the Fontanella, or Fons Pulfalis. The external Surface of thefe Bones is convex, and pretty fmooth; along their middle and inferior Parts, we find fome Eminencies and Cavities to facilitate their connecting with the fquamous or fcaly Part of the Temporals. We fometimes obferve a Foramen in the fuperior and pofterior Parts of thefe Bones.

Os Occipitis, thus named becaufe it lies in the pofterior Part of the Head. In this Bone, we are to obferve its Situation and Figure, which is irregular, and its State in Infants, in whom it is ufually compofed of four Pieces; after this we are to regard its Connections and its Subftance, which is very thick in fome Places.

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* They fay, it is through this that fome People have Ways of difcharging at the Ears the Smoak of Tobacco taken at the Mouth; but that cannot be, unlefs the Tympanum Membranum be lacerated; but People fubject to Deafnefs, may hear beft when their Mouths are open.

There

There are three Apophyfes, two of which are condyloïd, and ferve for the Articulation of it with the Atlas, or the firft Vertebra of the Neck, and to fupport the whole Cranium. The third is extended to the Sella Equina. In the internal Surface of this Bone in Adults, there is a Figure of a Crofs, and to this adheres the Sinufes and Proceffes of the Dura Mater; and within this there are alfo four Cavities, in which the pofterior Lobes of the Cerebrum or Brain, and the Cerebellum lie.

In the external Superficies, there are feveral fuperficial Eminencies and Depreffions to be obferved after the great Foramen: Thefe ferve for the Infertion of feveral of the Mufcles of the Head. The thinner Parts of this Bone are alfo defended by Mufcles, that cover them; which Provifion is very neceffary, becaufe we can leaft defend this Part; and Blows here are of worfe Confequence than in any other Part of the Cranium; becaufe Wounds in the Cerebellum, which is underneath, are mortal.

There are in moft Crania a Foramen behind each Apophyfis of the occipital Bone, through which pafs Sinufes, from the lateral Sinufes to the cervical Veins: By means of thefe Communications of the Sinufes, the Blood paffes from thofe that happen to be furcharged by any Pofture of the Head, into thofe, that from the fame Pofture, would have been almoft empty. Such Craniums as want thefe Foramina, have two Sinufes for the fame Purpofe.

The Bones of the Face.

Os Maxilla Superior, is always defcribed fingle, tho' it is manifeftly divided into two, by a Suture, which is fcarce ever obliterated. In each maxillary Bone we obferve three Apophyfes; the firft is called

called the Angle of the Maxilla, and forms a Part of the Arch of the Nofe; for which Reafon it is commonly called Nafal. The fecond is by fome called Malaris, or Jugal; and the third, Spine, which being united with that of the oppofite Maxillary, forms with it a kind of Creft for fixing the Cartilage, which makes a Part of the Septum Nafi, or Nafal Partition.

In the Maxilla, we alfo obferve a Canal, named the Superior Maxillary, which runs along the inferior Part of the Orbit; and the whole external Orifice is called by fome, the external orbitary Foramen. We here find alfo, at the Side of the Spine a Foramen, which in its inferior Part terminates by a Sinus, and, uniting with a fimilar one, in the other Maxilla, forms a Hole in the anterior Part of the Palate, called the incifory Aperture. In the internal Surface of this, there are fmall Holes which have no particular Names. In the Maxilla, we are alfo to confider three Sinufes; the firft at the Entrance of the Nafal Foffa; the fecond at the Entrance of the Orbitary Foffa; and the third performs the greateft Part of the Nafal Duct. In the internal Surface of each Maxilla, which forms Part of the Nafal Foffa, we difcover the Orifice of the maxillary Sinus, which is a very confiderable Cavity made through the whole Thicknefs of thefe Bones; we alfo remark along their inferior Part, feveral Apertures called Alveoli or Sockets, which are made in the Thicknefs of the Bones, and in Adults, their Number is generally eight in each Bone. The Parts of the Cavities that lie next to the Nofe, are only membranous, which makes the Cavities like Drums; perhaps to give a grave Sound to the Voice, when we let it through the Nofe. Impofthumations fometimes happen in thefe Cavities. The Signs of this Difeafe are great Pain about the Part, Matter in the Nofe on the Side difeafed,

diseased, stinking Breath, and rotten Teeth. Cowper was the first who described this Case, and the Cure; which is performed by drawing out the last Tooth but one or two, or more, if rotten, and through their Alveoli or Sockets, making a Perforation into the Antrum; or if drawing a Tooth makes an Aperture, which sometimes happens, and perhaps gave the first Hint of this Cure, then the opening must be inlarged, if it is not sufficient to discharge the Pus or Matter. The Teeth shall be described after the Description of the Maxilla inferior.

Ossa Palati, are commonly described as two small square Bones at the posterior Roof of the Mouth, though they are of much greater Extent, being continued up to the back Part of the Nostrils, to the Orbit of the Eyes. Each Palate Bone may therefore be divided into four Parts, viz. the Palate Square, the Pterygoïd Process, Nasal Lamella, and Orbitary Process: In these Bones we are also to consider two Sinuses and one Foramen. Of these Sinuses, one contributes to form a particular Duct, whose Orifice is observed in the posterior Part of the Palate; it is called the Gustatory Foramen, or the posterior Foramen of the Palate, in order to distinguish it from the incisory one, by some called the Anterior. The other Sinus helps to form the Spheno, by others called the Pterygo Foramen of the Palate. The Size of this is to be regarded, and the Construction of the Orifice or Aperture in living Subjects; also its Use, which is double; first, for the Assistance of the Voice; secondly, for the Secretion of a mucous Matter. We are also to observe the Nasal Canal.

These Bones are very complete in new-born Infants, the Nasal Lamella, being thicker and stronger than in Adults; but the orbitary Pro-

ceſſes have not the Cells which appear in the Bones of Adults.

When we are acquainted with the Structure of theſe Bones, the Reaſon is evident, why the Eyes are ſo much affected by Ulcers of the Palate, as to be often attended with Blindneſs, which frequently happens in ill-managed Venereal Diſeaſes, &c.

Ossa Turbinata, or Spongiosa Inferiora, are ſo named from their pyramidal Figure and ſpongy Texture, without any ſmooth, firm, or external Lamella, and from their Situation at the inferior Part of the Noſtrils, their Uſe is to ſtraiten the Noſtrils, to afford a large Surface for extending the Organ of Smelling, to prevent the Sharpneſs of the Air from ruſhing this way into the Lungs, and little Inſects getting into the Fauces; and they increaſe alſo the Expanſion of the Pituitary Membrane, for various Purpoſes; likewiſe to aſſiſt in forming the inferior Part of the lachrymal Ducts; the Orifices of which into the Noſe, are concealed by theſe Bones. Theſe Oſſa Turbinata are complete even in a new-born Infant.

Ossa Unguis, or Lachrymalia, are ſo called, becauſe their Figure and Magnitude is ſomething like a Nail; and by the Tears paſſing upon them into the Noſe, they are named Lachrymalia. Each of theſe Bones are ſituate in the Canthus Major, or Corner of the Orbit of the Eyes. Theſe unguiform Bones, compoſe the anterior internal Parts of the Orbits, lodge the lachrymal Sac and Duct, and cover the Cellula Ethmoïda; there is a Foramen into which the Puncta Lachrymalia lead, to carry off any ſuperfluous Moiſture, from the Eyes into the Noſe From which Situation, and tender Subſtance of theſe Bones, we ſee how eaſily an unſkilful Surgeon may deſtroy a conſiderable Share

Share of the Organ of Smelling, in performing the Operation of the Fistula Lachrymalis; but these Bones, when hurt, will exfoliate without much Difficulty, and consequently the Wound will be soon cured, unless the Patient labours under a general Cacoethes, or there is a Predisposition in the Bones to a Caries. These Bones are fully formed in a new-born Child.

Ossa Malarum, Jugalia Zygomata, or Cheek Bones. These Bones form the anterior, inferior, and external Parts of the Orbits. They have each four Processes, one of which joins the Apophysis of the temporal Bone; the second reaches the Frontal, the third is connected with the superior Maxilla, and the fourth is the posterior superior one, which is the longest and thickest, called the Superior Orbitary Process, and all form Arches, which Anatomists call Zygomata, or Ossa Jugalia, which signify Yokes. These Bones concur greatly in forming the inferior Part of the Orbits, and the Canthus Minor; they also make the prominent superior Part of the Cheeks most remarkable in lean Persons. We find commonly on the external Surface of the Ossa Malarum, small Foramina, for the Transmission of nervous Filaments and sanguiferous Vessels sometimes into the Orbits. On the internal Surface, the Foramina for the Passage of the nutritious Vessels to them are very conspicuous. The great Fissure at the external Orbit, may be considered as an Aperture common to these Bones, Sphenoïd, Maxillary, and Palate. The Substance of them is in Proportion to their Bulk, thick, hard, and solid, with some Cancelli.

Ossa Malarum are intire, and fully ossified in all their Parts in Infants.

Vomer; thus called by the Fathers of Anatomy, as it somewhat resembles a Plough-share.

This Bone forms the inferior and posterior Parts of the Septum Narium; its Figure is an irregular Rhomboïd or Square; posteriorly it appears in an oblique Direction. The superior Side is firmly united to the Basis of Os Sphenoïdes, and to the Nasal Lamella of the Ethmoïdes, and is received on the Processus Azygos of the Os Sphenoïdes. The inferior Side is firmly united to the Nasal Spines of the Maxillary and Palate Bones. The posterior Edge of the Vomer, is broader above; but as it descends forward, becomes thinner, tho' it is still solid and firm. Its inferior Edge which rests on the Nasal Spine of the Palate Bones and Maxillary, has a little Furrow on each Side of a small Ridge, answering to the Spines of the Bones of different Sides, and the Interstice between them. This Edge and the superior one meet in the pointed anterior End of this Bone.

Its Situation is not always perpendicular, but often inclined, as well as the Nasal Lamella Ethmoïdæa, to one Side.

The Vomer divides the Nostrils, inlarges the Olfactory Organ by affording room for expanding the Membrana Narium on its Sides, and sustains the Lamella of the Palate, and Maxillary Bones; which otherwise might be in Hazard of being pressed into the Nostrils, whilst the Vomer is secured from moving to one Side or other by the double-connected Schindylesis, by which it adheres to the superior and inferior Bones.

Ossa Nasi, or the proper Bones of the Nose, are two connected together; each of these Bones is of an oblong square Figure, the superior Extremity being narrow and thick, the inferior oblique and thin; the middle Part curved inwards near the

the superior End in some Subjects, in others almost strait.

The anterior or external Side is convex, though a little depressed or hollowed above its Middle. The posterior Side is gently concave; the superior Extremity is very thick, full of Points and Depressions; the inferior Extremity is thin, unequally indented, and cut obliquely in such a Manner, that the two Bones, connected form an acute Slope; the interior Rim, contiguous to the same Margin of the other Bone, is even, except towards the superior Part, where there are sometimes little Indentations, there is a small Foramen towards the concave Side, (which often is wanting in one of the Bones); when they are connected, these Edges represent a sort of Crista, or prominent Line, answering to the Septum Narium. About the middle of the external Side, sometimes higher, sometimes lower, there is a Foramen, which is often deficient in one of the Bones, and at other times several of them are not perforated.

The Substance of these Bones is almost compact, however, sometimes, there are some Cancelli towards the superior Extremities.

They are connected mutually above, to the Nasal Apophysis of the Os Frontis, laterally to the Nasal Apophyses of the Ossa Maxillaria, and interiorly or posteriorly to the anterior Rim of the perpendicular Lamina of the Os Ethmoïdes, by Means of the prominent Line already described.

They form the anterior and superior Portion of the Nose, and Part of the Septum Narium.

In an Infant the Nasal Bones are proportionably complete.

Maxilla Inferior, Mandibula, Facies, or the Lower Jaw, is composed of two Pieces in

young Subjects, without including the Teeth. Theſe two Pieces are, in Proceſs of Time, united by a Symphyſis, which it is impoſſible to ſeparate.

They have Surfaces, one external, which is convex; and another internal, which is concave. We alſo diſtinguiſh it in a Body and two Extremities; the Body is, as it were, divided in its Middle by a prominent Line, which denotes the Place of the Union of the two Pieces, which compoſe the inferior Maxilla in Children; and this Line is called the Symphyſis of the Mentum or Chin.

The Extremities have two Apophyſes on each Side; the anterior ſharp thin ones are named Coronoïd; the poſterior ones are called Condyles, and terminate in an oblong ſmooth Head, ſupported by its Cervix.

The Foramina of the Maxilla, are two on each Side; one at the Root of the Proceſſes internally, where a large Branch of the third Branch of the fifth Pair of Nerves and an Artery enter, and a Vein returns. A ſmall ſharp Proceſs frequently projects poſteriorly from the anterior Edge of this Foramen, and from its inferior Side, either a ſmall ſuperficial Canal deſcends, or a Furrow is to be obſerved, where a ſmall Branch of the Nerve is lodged, in its Way to the Mylo-hyoïdeus Muſcle and ſublingual Gland.

The other Foramen is external, at the Confines of the Chin, where theſe Veſſels have their egreſs. The Canal betwixt theſe two Foramina, is formed in the Middle of the Subſtance of the Bone, and is pierced by a great Number of ſmall Apertures, by which the Nerves and Blood-Veſſels of the Cancelli and Teeth paſs. The Extremity of this Canal is continued a little farther than the external Foramen at the Chin. We may eaſily conceive how the ſeveral Motions of the inferior Maxilla

illa are performed: For while the Teeth of both Jaws coincide, the Condyles securely play in the Cavities; but when the inferior Teeth are advanced forward, beyond the Range of the superior, the Maxilla rests on the Tubercles, by which the necessary Advancement of this Bone is allowed; and notwithstanding the Change of Place, a firm Axis of Motion is still afforded: Though at the same Time it must be granted, that in this straining Position we cannot open our Mouths, unless by a convulsive Action of the Muscles, and then not without some Danger of a Luxation of the Condyles, which often happens to old People, or Children in yawning. Whence the common Practice of Nurses in restraining the Jaws of Children from opening too wide in that convulsive Motion, is far from unreasonable. These Cartilages also serve to render the Articulations loose enough for performing the lateral Motions; and therefore, by a quick Succession of the Motions forwards, to one Side, backwards, and then to the other Side, the Condyles may be moved in a Circle, which is of good Use in chewing.

Here a general Remark may be made, That wherever such moveable Cartilages are found, either the articulated Bones are of such a Figure, or so joined and fixed by their Ligaments, that little Motion would be allowed without such Cartilages; or else some Motions are necessary to the right Use of the Member, which the Form of the Articulation would not otherwise admit of. This will more fully appear after the other Articulations with such Cartilages are described *.

After this Description of the Incasement of the Teeth, and the Mechanism of the Muscles, which

* Vid. Edinburgh Medical Essays, Vol. 1.

act principally on this Bone, and those of the Os Hyoïdes, the Connections of the membranous Ligament, of the Tongue to the Maxilla, and its Motions, it is easy to see that the inferior Maxilla is the principal Instrument in Mastication, Deglutition, and Speech.

The TEETH come next to our Consideration. They are the Furniture of the Maxillæ, and are very hard, osseous Substances, fixed in their proper Cavities in them in the Manner of Nails. This Kind of Articulation is called Gomphosis. In regard to the Teeth we are to consider their Situation in deep Sockets, and their Connections, by means of the Periosteum and Gums. Their natural Colour is white, their Number from Twenty-eight to Thirty-two, viz. Fourteen, Fifteen or Sixteen in each Maxilla.

*The broad thick Part of the Teeth, which appears without the Socket, is the Basis or Body. The smaller Processes sunk into the Maxillæ, are the Roots or Fangs. At the Place where the Base ends, and the Roots begin, there is generally a small circular Depression, which some call the Cervix or Collar. Each Tooth is composed of two Substances, its Cortex, and an internal bony Substance. The Cortex has no Cavity or spongy Substance for Marrow, and is so solid and hard, that Saws or Files, can with Difficulty, make Impression on it; notwithstanding the great Hardness of this Cortex, it is wasted by Attrition. The internal Substance of the Teeth is osseous, with its Fibres running strait, according to the length of the Teeth, which, when exposed to the Air, by the breaking or falling off of the hard Cortex, must soon corrupt or be destroyed, as is the Nature of all Bones; and thence carious

* Discription of the Teeth according to MONRO.

Teeth

Teeth are often quite hollow within, when a very small Aperture appears only externally. The osseous Substance of the Teeth, has a Canal formed in its Middle, wherein their Nerves and sanguiferous Vessels are transmitted; which they certainly need, being constantly wasted by the Attrition, they are subjected to in Mastication, and for their farther Growth after they first appear. And it is certain, that they are capable of becoming longer and broader in Adults; which does remarkably happen when any Tooth of a young Person is taken out; for then the opposite grows longer, and those on each Side of the empty Socket, become broader; so that when the Maxillæ are brought together, it is scarce observable, where the Tooth is wanting. The Root of each Tooth has a distinct Canal with Vessels and Nerves within it. The State of these Nerves bears a strong Resemblance to that of the Cutaneous, which serve for the Sensation of the Touch. It is certain, as INGRASSIAS justly affirms, that they are capable of becoming longer and broader in Adults; which does remarkably happen, when any Tooth of a young Person is taken out: For then the opposite one becomes longer, and those on each Side of the empty Socket turn broader; so that when the Jaws are brought together, it is scarce observable where the Tooth is wanting.

The Vessels are easily traced as long as they are in the large Canal, but can scarce be observed in their Distribution from that to the Substance of the Teeth of Adults: RUYSCH however affirms that he could, after Injection, trace the Arteries into the hardest Part of the Teeth. And LEWENHOEK * suspected the Fibres of the Cortex to

* Arcan. Natur. Continuat. Epist. p. 3.

be

be Vessels. In Children I have frequently injected the Vessels of the Teeth as far as the Base: And in such as are not entirely ossified, one can with a lucky Injection fill so many Vessels, as to make the Inside of the cortical Part appear perfectly red. This plentiful Supply of Vessels must expose the Teeth to the same Disorders that attack other vascular Parts; and such Teeth as have the greatest Number of Vessels, must have the most numerous Chances of being seized with these Diseases.

Every Root of each Tooth has such a distinct Canal with Vessels and Nerves in it. These Canals in the Teeth with more than one Root, come nearer each other as they approach the Basis of the Tooth, and at last are only separated by a very thin Lamella, which being generally incomplete, allow a Communication of all the Canals, and frequently one common Cavity only appears within the Basis, in which a pulpy Substance composed of Nerves and Vessels is lodged. And since the Cuticula can be rubbed off or cut without Pain, allows the Nerves to be affected by Heat or Cold, and transmits acid or austere Liquors, that blunt the Touch considerably, and give an uneasy Sensation at the same time; and that several Substances, notwithstanding this interposed Membrane, do create a painful Tremor, by their numerous or frequently repeated Impulses. When, I say, all this is considered, the analogous Phænomena in the Teeth, which the Antients disputed so much about, will appear to be of no difficult Solution.

In young Subjects, different Stamina or Rudiments of Teeth are to be observed within the same Alveoli, those next the Edge of the Gums hinder ordinarily the deeper seated ones from making their Way out, while these prèvent the former from sending out Roots, or from entering deep into

to the osseous Alveoli of the Maxilla by which they come to be less fixed.

The Entrance of the Canals for these Vessels, is a small Orifice, to be seen a little aside of the extreme Point of each Root; sometimes (especially in old People) this Foramen is intirely closed up, and consequently the Nerves are destroyed, as M. DE LA HIRE jun. of the Academy of Sciences at Paris, has remarked.

The Teeth are seen for a considerable time, in Form of Mucus, contained in a Membrane, afterwards a thin cortical Lamina, and some few osseous Strata appear within the Membrane, with a large Cavity filled with Mucus in the Middle, and gradually this exterior Shell grows thicker, the Cavity decreases, the Quantity of Mucus is lessened, and this Induration proceeds, till the whole Body is formed, from which the Roots are afterwards produced.

Children seldom have Teeth appearing without their Gums, when new born, but when they are two Years old, or little more, they have twenty, and their Number does not increase till about seven Years of Age, when the Teeth, that first made their way through the Gums, are thrust out by others, that have been formed deeper in the Jaw, and some more of the Teeth begin to discover themselves, farther back in the Mouth. About fourteen Years of Age, some more of the first Dentition are shed, and the Number is increased. This shedding of the Teeth is of good Use; for if the first had remained, they would have stood at a great Distance one from another, because the Teeth are too hard in their outer Crust to increase so fast as the Maxillary Bones do; whereas both the second Stratum, and the Teeth that come out late, meeting (while they are soft) with a considerable Resistance to their Growth, in Length from

from those situated upon them, will necessarily come out broad, and fit to make that close Guard to the Mouth which they now form.

Tho' the Teeth so far agree in their Structure, yet because of some Particulars, wherein they differ, they are generally divided into three Classes, viz. Incisores, Canini, and Molares. The Incisores are the four anterior Teeth in each Maxilla receiving their Name, from their Office of cutting our Aliment, for which they are excellently adapted, being each formed into a sharp cutting Edge at their Bases, by the Extremity of their anterior Side turning inwards, while the posterior Surface is sloped down and hollowed; so that they have the Form of Wedges; and therefore their Power of acting must be considerably increased, as is demonstrable in Mechanics.

Seeing the Action of the Incisores, a perpendicular Compression is only necessary, without any lateral Motion, they are not so firmly fixed in their Alveoli as the other Teeth are, having neither so many nor so long Roots, but are only possessed of one short Stump. The Incisores of the superior Maxilla, especially the two middle ones, are broader and longer than those of the inferior Maxilla.

In a new-born Infant, the Cortex Body of these Teeth is only hardened.

Canini, from the Resemblance to Dog's Tusks, are one on each Side of the Incisores in each Maxilla. The two in the superior Maxilla are called Eye Teeth, from the Communication of Nerves, which is said to be betwixt them and the Eyes. The two in the inferior Maxilla are named Angular or Wike-Teeth, because they support the Angles of the Mouth. The Bases of the Canini are broader than those of the Incisores, though they are also sloped on the interior Side. They are longer than

any

any other Teeth, and stronger than those of the former Class. The Canini of the superior Maxilla are the largest and longest, and have the Extremity of their Roots crooked, and so are more firmly secured in their Alveoli. Hence it is evident how well these are adapted for breaking and bruising solid Bodies; this being a Sort of mixed Action, between Cutting and Grinding, the proper Offices of the other two Classes. The Canini of a Child are formed much in the same manner as the Incisores are.

The Dentis Molares or Grinders, which have got their Name because they grind our Food, are generally five in each Side of each Maxilla, in all twenty. They are the broadest Teeth of any, with both Sides equally raised or nearly so, but are unequal and scabrous at their Bases, to be the better fitted for their Office. The Body of the first is generally the least, and comes nearest to the Canini in its Shape; the third and fourth are the largest, and the fifth is next in Size to them.

Some of the Molares have only one Root, others have, two, three, four, or five to prevent their loosening by the lateral Pressure, which they suffer; and in the superior Maxilla, their Roots are commonly more numerous, and more separated than in the inferior, because the superior Teeth are more liable to fall out, by their Situation and the Structure of their Alveoli, as Galen has observed. The Number, however, of the Roots of each of them is very uncertain, sometimes they are more, sometimes fewer, frequently several Roots are united, at other Times they are all distinct. The Disposition of such as are distinct is also various; for in some, the Extremities of the Roots go out strait, in others they separate, and in others again, they are crooked inward. In general, we observe, that the farther back in the Mouth

Mouth these Teeth are situated, the Number of Roots is greater, and when they are united, we can still distinguish them, by observing the Number of small Apertures at their Points, which determine the Number of Roots, the Tooth ought to be reckoned to have. The cortical Substance at the Basis, of the Grinders, is thinner than in any other Teeth. The two Teeth that are placed farthest back in each Maxilla, are distinguished by the particular Name of Dentes Sapientiæ; because they commonly cut the Gums about the twenty-first Year of our Age, when the Laws allow People to be Sui Juris, and capable to manage their own Affairs; their Bodies are smaller, and their Roots are not generally so numerous as in the third and fourth. At the Time of Birth, only two Dentes Molares in each Maxilla, have begun to ossify, and that at little more than the Basis, which has several sharp Points standing out from it. The Teeth are principally fastened into their Alveoli by the Means of the Gums, except the Molares and Dentes Sapientiæ, which are fastened by Gomphosis; and some Anatomists have described the Articulation of the others by the Means of Sysareosis; as it appears by their falling out, when the Gums are any ways attacked in scorbutic Diseases or Salivation. The Uses of the Teeth are to masticate our Aliment, and assist us in Pronunciation; besides the Ornament to the Mouth.

From what has been said, the Answers to the following Queries may easily be given.

Why in Children do the Dentes Scisores first cut the Gums, the Canini next, and Molares last?

Why do Children shed their Teeth at a certain Age?

Wherefore have these temporaneous Teeth generally no Roots, or very small ones?

Why have these first Teeth sometimes Roots?

Why do these Roots frequently come thro' the Gums?

Whence come Butter and Buck Teeth?

How do these Teeth sometimes go into the narrow Row with the others, after pulling out a rotten Tooth near them?

How have some People got two Rows of Teeth in one or both Jaws?

Why do the Teeth of old People loosen, and drop out intire?

Whence arise the new Sets of Teeth which several old People obtain?

Why are not the Gums of toothless old People torn by the hard Sockets in chewing?

Why are the Teeth insensible when slightly filed or rasped?

How come they to be sensible of Heat or Cold, to be set on Edge by Acids, or to give such an uneasy Sensation, when gritty or sandy Substances are rubbed between them?

What is the Reason of some Persons dying convulsed, upon rasping or filing down an overgrown Tooth?

What Parts are affected in the Tooth-ach?

Why are the Dentes Molares most subject to that Disease?

How do the Teeth break and moulder away without any Pain in some People, and not in others?

Whence proceeds the violent obstinate Hæmorrhagy which sometimes attends the drawing of Teeth?

Why is it more difficult and dangerous to draw the Eye-teeth than any other?

What makes it impossible frequently to draw Grinders without bringing away Part of the Jawbone with them, or breaking the Fangs?

Why

Why have small Worms been sometimes found in carious Teeth?

A Particular Description of the FORAMINA of the CRANIUM, according to HEISTER.

The Apertures in the Cranium are to be divided into external and internal; by the external, we mean those which are most conspicuous on its external Surface: By the internal, those which are most obvious in the internal. Of the larger internal Foramina, or Apertures, we count eleven Pair, affording Passage to the Arteries, Veins, and Nerves of the Brain; and besides these, we are to remark the Magnum, which is a single one; viz. a Branch of the fifth Pair, to the emissary Foramen of the occipital Bone, which gives Passage to the Medulla Spinalis, and with it to the accessory spinal Nerves, and to the vertebral Arteries.

We are to pay a particular Regard to the first Pair of these Foramina (which may indeed be called more properly a Congeries of the Foramina of the Os Cribrosum. These give Passage to the Filaments of the first Pair of Nerves, called the Olfactory Nerves. The second Pair is in the sphenoïd Bones, and gives Passage to the Optic Nerves. The third Pair are called the lacerated Foramina, and give Passage to the third and fourth of Nerves, first Branch of the fifth Pair, and to the sixth Pair, as also to the Emissary of the Receptacles of the Dura Mater. The fourth Pair are in the sphenoïd Bone, and give Passage to the second Branch of the fifth Pair of Nerves, which is distributed to the several Parts of the superior Maxilla. The fifth or oval Foramina gives Passage to that of the Dura Mater. The sixth is a very small Foramen, and admits an Artery, which is distributed over the Dura Mater, and is that which forms

forms the Impressions of little Shrubs or Trees on the internal Surface of the Parietal Bones. The seventh is placed between the Sella Equina and Petrose Apophysis, and transmits no Vessels, being obstructed by the Dura Mater. The eighth Pair of Foramina give Passage to the Carotid Arteries, whence it is called the Carotid Foramina; and the intercostal Nerve has its Egress also at this Opening. Through the ninth, which is in the Os Petrosum, passes the auditory Nerve. Through the Tenth, which is between the Os Petrosum, and the Occipital Bone, pass the Par Vagum, and the lateral Sinuses of the Dura Mater, together with the Spinal Nerve. The eleventh is in the Os Occipitis, near the Edge of the Foramen Magnum; and thro' this passes the ninth Pair of Nerves called the Lingual.

Besides these Foramina, there are also a Number of little ones in the Os Petrosum, often very conspicuous. One of these returns a Branch of the auditory Nerve to the Dura Mater; and the other principal one transmits the sanguiferous Vessels to the Labyrinth or the internal Organ of Hearing.

In the external Foramina of the Cranium, there are two proper ones of the Os Frontis, a little above the Orbits. These are, from their Situation, called Supraorbitalia: They give Passage to the ophthalmic Nerve of Willis; but in their Place, we often meet with only a superficial Incisure. Besides these, there are four other Foramina, common to the Os Frontis, and to the Plane or Papyraceous Bones of the Orbit: Two of these are placed on each Side, and they transmit little Nerves and Vessels to the Sinuses of the Ethmoïd Bone.

In the Parietal Bones there is one which serves for the Passage of a Vein from the Cutis of the Cranium into the sagittal Sinus to the external Veins of the Head: This, however, is often want-

ing; and many Anatomists therefore do not mention it.

In each of the Temporal Bones, there are three common Foramina: The First of these is the Foramen Jugale, which serves for the Passage of the Crotaphite Muscle; a Second is large, in which is the Sinus of the Jugular Vein; and the Third is the Ductus Eustachii, already mentioned, situated between the Petrosum and Sphenoïdes, and leading from the Mouth into the internal Ear. Besides these common Apertures of the Temporals, there are also three proper ones; First, The Meatus Auditorius or Auditory Passage. Secondly, The Aqueduct of FALLOPIUS, situate between the Mastoïd and Styloïd Process, and transmitting the hard Portion of the Auditory Nerve. Thirdly, A Foramen behind the Mastoïd Process, serving for the Ingress of a Vein into the lateral Sinus, or for the Egress of one from the lateral Sinus to the Veins of the Occiput.

In the Occipital Bone, there are two Foramina, situate behind the Condyloïd Apophyses, and serving to give Passage to the Vertebral Veins into the lateral Sinuses of the Dura Mater: These Foramina, however, are wanting in many Crania.

In the Sphenoïdes, besides the internal ones already described, and the Apertures of the Sinuses into the Nostrils common to them, with the Bones of the Palate, and which are the Apertures of the Nares and Fauces, there is another Canal in the superior Part of the Pterygoïd Processes, serving for the Passage of the Novum Emissarium of the Dura Mater.

In the Os Ethmoïdes, there are, First, Those common to this Bone with the Os Frontis, situated anteriorly in the Orbit, and already described. And Second, the Apertures of the Ethmoïd Sinuses into the Nostrils.

The

The Foramina of the superior Maxilla are, First, One called the Anterior of the Palate, situate behind the foremost Dentes Incisores, and opening into the Nostrils.

But this is usually so closed up in living, and even in dead Subjects, by the Membrane of the Palate, that nothing of its Aperture is distinguishable within the Mouth; nor is it certainly known, that any Thing is transmitted thro' it. It is also to be observed, that as the Membrane of the Mouth, is evidently joined to that of the Nostrils, by means of this Canal, a very sufficient Use of it may be the making the Union between that Membrane, and that of the Palate, the stronger.

Secondly, the Infra Orbitale: Its Use is to give Passage to the Fifth Pair of Nerves. Thirdly, There are other Foramina behind the posterior Molares, through which the Vessels and Nerves pass to the Maxillary Sinuses. Fourthly, There is an Incisure in the exterior Side of the Bottom of the Orbit, common to this, and to the Sphenoïd Bone, and serving to give Passage to the Vessels going to the Eyes and Nose. The Fifth is the Nasal Canal, common to this Bone and the Os Unguis. The Sixth are the Apertures of the Sinuses into the Nostrils. And the Seventh is the posterior Foramen of the Palate common to this Bone, with that of the Palate, and serving to convey the Nerves to the Palate.

In the Os Jugale there are, First, The Jugale or common Foramen. Secondly, The proper Foramen of the Jugale, which is sometimes single, sometimes double, and serves for the Passage of a Nerve.

In the Os Palati, besides the Foramen common to that, with the adjacent Bone, there is a proper one, situate near where it is connected to the

Pterygoïd Proceſſes, and ſerving for the Paſſage of Nerves to the Palate.

In the Maxilla inferior, there are two Foramina, in the internal Surface, ſerving for the Paſſage of an Artery, a Vein, and a Nerve, into the very Subſtance of the Maxilla, for its Nutrition, and that of the Teeth; and there are alſo two in its external Surface, which ſerve to give Egreſs to the ſame Veſſels, which are thence diſtributed to the Gums and the Chin.

In the Examination of different Crania, other Foramina beſides theſe will occaſionally be found in different Places. Theſe are either extraordinary, and Luſus Naturæ, as is often the Caſe; or they are otherwiſe ſuch as ſerve only to give Paſſage to Veſſels, ſerving for the Nutrition of the Bones in which they are diſtributed

According to the Diviſion made of the Skeleton, we ſhould now proceed to the Deſcription of the Trunk, but muſt firſt examine a Bone, which cannot well be ſaid to belong to either the Head or the Trunk; nor is it immediately joined to any other, and therefore is very ſeldom preſerved with Skeletons; however it is generally deſcribed by Anatomiſts after the Bones of the Face: In Obedience, therefore, to the prevailing Method, we ſhall at preſent examine its Structure.

Os Hyoïdes, is ſituated horizontally between the Root of the Tongue and the Larynx; and is likewiſe called Os Linguæ, Bicorne, &c: In young Subjects this Bone is divided into three Portions, and therefore for the better underſtanding its Structure, we ſhall diſtinguiſh it into Baſis, Cornua, and Appendices. Its Baſis, or Body, occupying its middle Part, and two lateral ones called Coruna; it is to theſe that the Tongue is connected. In Adults there are often, at the Junctures of theſe with the Baſe,

Base, two other Frusta, very small, and thence overlooked by most Anatomists, these are nearly of the Shape of a Wheat-Corn, and may thence be called Ossa Triticæ.

When the Body of the Os Hyoïdes joins on each Side with its Cornua, a small styliform Process rises upward and backward, into which the Musculi Stylo-Hyoïde Alteri and Part of the Hyo Glossi Muscles are fixed. These Appendices frequently remain cartilaginous many Years.

The Substance of the Os Hyoïdes is cellular, but covered with a firm external Lamina, which is of sufficient Strength to bear the Actions of so many Muscles as are inserted into it. It is not articulated with any Bone of the Body, except by means of the Muscles and Ligaments mentioned. The Use of the Os Hyoïdes is to serve as a solid Lever, for the Muscles to act with, in raising and depressing the Tongue and Larynx; or in inlarging and diminishing the Capacity of the Fauces.

As Four Cartilages of the Larynx, often ossify in old People, many have reckoned them among the Number of the Bones; they are called the Thyroïdes, the Cricoïdes, and the two Arytanoïdes. The Nature and Use of these Parts, however, are much better understood when we examine them on recent Subjects, than when in the Skeleton, of which at best they make but an improper Part.

We observe all the Bones of the Cranium are found to be incomplete in new-born Infants. The Sinus and its Diploë, or Meditullium, are almost intirely wanting; that the osseous Fibres in the Formation of most of them, are carried in Rays, from a Center towards the Circumference, and generally are not single as in Adults; but composed each of several Frustules, or little Pieces; nor are the Sutures at that time formed; final-

ly there are triquetrous little Bones between them*. In Adults, the several Bones of the Cranium are in general articulated by Sutures: These Sutures are either common or proper; the proper ones are distinguished into true and false, or spurious; they are called true Sutures, when the Bones are connected in an amazing Manner, by means of a Multitude of inequal denticulated Eminencies, forming an Appearance somewhat like the Edge of a Saw: These Denticulations enter mutually into each others Sinuses, plainly visible externally, and are distinguished as follows, viz.

The proper ones are, 1st, The SUTURA CORONALIS, which runs across the Cranium, from one superior Edge of the Sphenoïd Bone to the other, and connects the parietal Bones to the frontal.

2dly, SUTURA SAGITTALIS, connects the Parietal Bones; begins at the Os Occipitis, and is continued to the Os Frontis, in Children down to the Nose; the Os Frontis in them, being two Bones, and sometimes so in adult Bodies.

3dly, SULTURA LAMBDOÏDALIS, connects the back Part of the Ossa Bregmatis or Parietal Bones, to the superior Part of the Occipital: In this Suture are frequently observed some small Bones called Ossa Triquetra, and sometimes in other Sutures.

The common ones are, 1st, SUTURA SQUAMOSA, which is made by the superior Part of the Temporal and Sphenoïd Bones wrapping over the inferior Edges of the Parietal Bones.

2dly, SUTURA TRANSVERSALIS, which runs across the Face, through the Bottoms of the Or-

* These Bones are called by some Ossa Triquetra or Ossa Wormiana. HEISTER has preserved a Cranium, in which the Lambdoïdals were two Inches broad, and there were more than twenty of these distinct Bones.

bits

bits of the Eyes; it connects the inferior Edge of the Frontal Bone, to the Ossa Nasi, Ungues, Plana, Palati, and Jugula or Malarum. Some Authors mention also a Number of other common Sutures, such as the Nasal, the Palati, the Lachrymal, and the like; but these are called by the Ancients Junctura per Harmoniam; which comprehend the Bones of the Face.

The Use of the Sutures, is, 1st, that the Dura Mater may in those Places, be very firmly connected to the Cranium and Pericranium. 2dly, That in Infants, the Head may be more easily extended in its Growth, from the several Bones, being at that Period disunited at these Places. 3dly, That the Transpiration from the Brain, may be the more free and easy, at that time of Life in which they are open, and at which also the Habit is more humid. 4thly, That very large Fractures of the Cranium might be in some measure prevented. And, Lastly, There is another Disadvantage in their Openness in Children, namely, that medicinal Applications, to the external Part of the Head may penetrate and do Service; and in the Time of Delivery, yield by Compression in the Passage.

Synosteography: or, the Cartilages and Ligaments of the Head, &c.

The Condyloïd Apophyses of the Os Occipitis, the Glenoïd Cavities or articular Fossulæ of the Temporal Bones, the Eminencies next these Cavities, and the Condyloïd Apophyses of the inferior Maxilla, are all crusted over with very white and smooth Cartilages; and there is likewise an inter-articular, or moveable Cartilage in each Articulation of the inferior Maxilla, with the Temporal Bones.

This Cartilage is thick near the Circumference, very thin and tranfparent, and fometimes perforated in the Middle.

The inferior Side is uniformly concave, anfwering to the oblong Convexity of the Maxillary Condyle; but the fuperior Side is partly concave, and partly convex, fuited to the Foffula and Eminence in the Temporal Bone. The Mechanifm of this Cartilage fhall be explained in the Defcription of the Mufcles.

The remaining Cartilages of the Bones of the Head, viz. The cartilaginous Septum and other Cartilages of the Nofe, the fmall cartilaginous Ring in each Orbit, the Cartilages of the external Ear, and thofe which are connected to the Os Hyoïdes, muft be referred to the Defcription of the Part.

The Ligaments of the Bones of the Head are thefe: 1ft, Thofe between the Occipital Condyles, and the fuperior Apophyfis of the firft cervical Vertebra. 2dly, Thofe between the Os Occipitis and Apophyfes Dentiformis of the fecond Vertebra. 3dly, Thofe of the Articulation of the inferior Maxilla, with the Temporal Bones. 4thly, thofe by which the Os Hyoïdes is connected the Styloïd Apophyfes *.

The Ligaments of the Occipital Condyles refemble the articular Ligaments of the Vertebræ, confifting of a ftrong Texture of ligamentary Filaments, placed clofe by each other round the whole Articulation, and fixed by one End in the occipital Bone, by the other in the fuperior Apophyfes of the firft Vertebræ, and furrounding the capfular Ligaments.

* I here pafs over the Ligaments which connect the Cartilages of the Ear, thofe of the Nofe, the fmall cartilaginous Pullies of the Orbits, and the ciliary Cartilages.

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The Ligaments which go from the Os Occipitis to the Apophysis Dentiformis are very thick, and disposed in separate Fasciculi which afterwards unite.

The Fasciculi are fixed immediately before the great occipital Foramen, in the inferior Side of the Apophysis Basilaris, and the united Ligament is inserted in the odontoïd Apophysis, in the manner already mentioned.

The Ligaments of the Articulation of the inferior Maxilla are very strong, and are disposed and inserted much in the same Manner with those by which the Clavicle is connected to the Sternum. They are fixed by one Extremity round the glenoïd Cavity, or articular Fossula, and Eminence of each temporal Bone, by their Middle, round the inter-articular Cartilage, and by the other Extremity, round each Condyle of the inferior Maxilla. The Disposition of the capsular Ligament, with respect to the inter-articular Cartilage, is the same as in the Articulation of the Clavicle, with the Sternum.

LEC-

LECTURE VI.

The Bones of the Trunk.

THE Trunk comprehends all the Bones, which in a natural State lie between the Head and the four Extremities. These Bones are divided into three Parts; the Spine, Thorax, and Pelvis; the first of which, that is, the Spine, may be looked on as a common Part, the other two as proper.

The Spine and Vertebræ in general.

By the Spine is meant all that Order of Bones, which follow one another without Interruption, from the Os Occipitis downward, along the posterior Part of the Trunk. It represents a very compound folding Pillar, round on the anterior and on the posterior Side stuck full of Prickles or Points, representing so many particular Spines; having a Canal in the Middle, through its whole length, into which a great Number of Foramina open on each Side.

When it is viewed directly on the anterior or posterior Side, it appears strait, and to be composed of different Portions of Pyramids in a contrary Situation to each other; but viewed laterally it presents several different Curvatures.

The Pieces which form the Spine are of two Kinds; one single, the other compound. The single are generally twenty four in Number, called by the Name

Name of Vertebræ, from the Latin Word Vertendo, turning. The compound Pieces are two, the Os Sacrum, and Os Coccygis; the single Pieces are likewise called True Vertebræ, to distinguish them from the Portions which compose the other two, which are called False Vertebræ.

The true VERTEBRÆ are divided into three Classes, viz. Seven cervical, twelve dorsal, and five lumbal Vertebræ.

To have a clear Idea of the Structure and Disposition of each Vertebra, we must first examine what they have in common, and next, what is peculiar to the Vertebræ of each Class, or to any particular Vertebra therein: Afterwards, the Description of the Portions which compose the Os Sacrum and Coccygis will complete this first Part of the Trunk.

What is common to all the Vertebræ, may be reduced to their external Conformation, external Structure, Connection, and Uses.

In the Vertebræ in general, we are to consider the Body, Apophyses, and Cavities.

By the Body of the Vertebræ, we mean that principal Part or large Mass, situated anteriorly, and which supports all the other Parts. In most of the Vertebræ, the Body represents a Portion of a Cylinder cut transversly, the Circumference of which is more or less round on the anterior, and sloped on the posterior. It has two Sides, the superior and inferior; each of which is, as it were, bordered by a thin Lamina in Form of an Epiphysis.

The Apophyses in most of the Vertebræ are seven in Number; one posterior, called the Spinal Apophysis, which ends in a small Epiphysis, and has given the Name to the whole System of the Vertebræ: Two lateral, called Transverse Apophyses: And four, which are likewise lateral; two

two on each Side, one above, and one below. They are called by the general Name of Oblique Apophyses, and distinguished into superior or ascending, and inferior or descending. These four are the least of all the Processes of the Vertebræ, and each of them has a cartilaginous Side. I should chuse to call them articular rather than oblique Apophyses, for a Reason which shall be afterwards given, and I sometimes name them likewise the small Apophyses of the Vertebræ.

The Cavities in the Vertebræ are three large middle Foramina between the Body and the Apophyses. Four Scissures, two on each Side, one superior and small, and one inferior, which is larger. The great Foramen is Part of the vertebral or spinal Canal or Duct, and the Scissures of one Vertebra meeting those in another, form the lateral Foramina, which communicate with the Canal.

Though the Situation of the Vertebræ has been already mentioned pretty exactly, it will be proper to repeat it once more.

The Body is the anterior Part of each Vertebra; the Spinal Process, the posterior Part; the transverse and oblique, or articular Processes, are the lateral Parts; and the great Foramen is in the Middle of all these Parts.

The inner Substance is spongy, or like a Diploë, covered externally with a complete Substance, which, in the Body of the Vertebræ, is very thin, but thicker in the Processes.

The Vertebræ are joined together by their Bodies, and by their small Apophyses. The Bodies in a natural State are principally united by a cartilaginous Symphysis, that is, by the Intervention of a pliable and elastic Cartilage, as shall be explained: This cartilaginous Connection makes the lateral Foramina of the Spine larger in the Body than

than in the Skeleton, where theſe Cartilages are wanting.

Their Connection by the ſmall Apophyſes, is by Arthrodia, and not by Ginglymus, as ſhall be demonſtrated. Theſe two Articulations are ſecured by very ſtrong Ligaments.

OF THE CERVICAL VERTEBRÆ.

The CERVICAL VERTEBRÆ are the ſeven ſuperior; which are diſtinguiſhed from the reſt by theſe Marks. They are all, except the firſt, of near an equal Breadth: Their Bodies are ſmaller and more ſolid than any others, and flattened anteriorly, to make way for the Æſophagus. The poſterior Surface, which is alſo flat, is generally rough, or has ſmall Proceſſes riſing from it, where the Ligaments are fixed.

The ſuperior Surface of the Bodies of each Vertebra is made concave, by a ſlanting thin Proceſs raiſed on each Side.

The inferior Surface is alſo excavated, but in a different Manner from the former; for the poſterior Edge is raiſed a little, and the anterior is produced a conſiderable Way. Hence we ſee how the Cartilages between thoſe Bones, are more firmly connected, and the Articulations of any two Vertebræ, are more ſecure.

The Cartilages between theſe Vertebræ are thicker, eſpecially in reſpect of their Bulk, than thoſe belonging to the Vertebræ of the Thorax, becauſe of the larger Motion that is allowed here, and they are thickeſt anteriorly; which is one Reaſon why they advance forward as they deſcend.

The oblique Proceſſes of theſe Bones of the Neck more juſtly deſerve that Name, than thoſe of any other Vertebræ. They are ſituated ſlanting; the ſuperior Proceſſes, having their ſmooth and almoſt flat Surfaces, facing obliquely, poſteriorly,

riorly, and ſuperiorly, while the inferior oblique Proceſſes, have their Surfaces facing obliquely, anteriorly, and inferiorly.

The tranſverſe Proceſſes of theſe Vertebræ, are framed in a different Manner from thoſe of any other Bones of the Spine: For beſides the common Proceſs, riſing from between the oblique Proceſſes of each Side, there is a ſecond that comes out from the Side of the Body of each Vertebra; and the two Proceſſes, after leaving a circular Foramen, for the Paſſage of the cervical Artery and Vein, being united, are conſiderably concave ſuperiorly, with riſing Sides to protect the Nerves, that paſs in the Cavity; and at laſt each Side terminates in an obtuſe Point, for the Inſertion of Muſcles.

The ſpinal Proceſſes of theſe cervical Bones, ſtand nearly ſtrait poſteriorly, are ſhorter than thoſe of any other Vertebræ, and are perforated, or double at their Extremity; and hence allow a more convenient Inſertion to Muſcles, and a larger poſterior Motion.

The Foramina between the oſſeous Curvature for the Paſſage of the Nerves from the Medulla Spinalis, have their largeſt Share formed in the inferior of the two Vertebræ, to which they are common.

The Subſtance of the Cervicals, eſpecially of their Bodies, is not ſo porous or tender as that of the other two Claſſes.

So far the cervical Vertebræ agree in their general Characteriſtics, but ſtill have ſome particular Difference, which oblige us to conſider them ſeparately. The Firſt, from its Uſe of ſupporting the Head, has got the Name of Atlas, and by ſeveral Authors is called Epiſtrophea, from the Motion it performs on the ſecond.

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The Atlas, contrary to all the other Vertebræ of the Spine, has no Body nor ſpinal Apophyſis.

The Foramen, or Opening, in it is much larger than the reſt. It looks like an irregular bony Ring filled all round with Eminencies and Cavities. It may be divided into two Arches; the anterior or largeſt, and poſterior or ſmalleſt.

The anterior Arch is formed by two thick lateral Portions and a ſmall Curve middle Part, which, with the other two, makes a Sciſſure in the anterior Part of the great Cavity of the Vertebra. The lateral Portions may be looked upon as a Body in two Parts; without which, the firſt Vertebra would have been too weak to ſuſtain the Articulations. In the Middle of the convex Side of the poſterior Curvature is a Tubercle a little pointed, larger than the anterior Tubercle, and marked with muſcular Impreſſions on each Side, and on the ſuperior and inferior Edge. This Tubercle ſeems to be in the Place of a ſpinal Apophyſis.

The tranſverſe Apophyſes of the firſt Vertebra ariſe from the Middle of the lateral Portions, being perforated perpendicularly at their broad Origins. They are much longer than thoſe of the five Vertebræ below them, and contracting gradually, they terminate in an obtuſe Point, which is ſometimes in a Manner double, and marked on the ſuperior and inferior Side with muſcular Impreſſions.

The ſuperior articular Apophyſes, are larger than any other of the ſame Kind in the whole Spine. They are oblong cartilaginous Cavities framed in the ſuperior Side of the lateral Portions. Their Situation is almoſt horizontal, and their anterior Extremities, are turned more internally, that is,

nearer one another, than the poſterior. They are in a word, every way proportioned to the Condyles of the Os Occipitis.

The inferior articular Apophyſes are leſs concave, ſhorter, and broader; they are inclined laterally from the internal to the external, and from the ſuperior to the inferior. They are directly under the ſuperior Apophyſes; and thus the articulate and tranſverſe Apophyſes, the Foramina and lateral Portions, on each Side, are all in the ſame Line.

There is a long Sciſſure, or kind of Groove, between each ſuperior articular Apophyſis, and the poſterior Curvature of the bony Ring, reaching from the Foramen, in the tranſverſe Apophyſis poſteriorly: In which Sciſſure, the vertebral ſanguiferous Veſſels, in the natural State, make a Turn, before they enter the greateſt occipital Foramen. Sometimes, though very rarely, there is a complete Foramen in the Room of this Groove. There is another Sciſſure but more ſhallow, on each Side, between this Curvature and the inferior Apophyſis.

In the internal Circumference of the great Foramen of this Vertebra, in the Middle of the great Sciſſure, is a cartilaginous Impreſſion, for the Articulation of the Axis of the ſecond Vertebra; and on each Side of that Sciſſure: Between the ſuperior and inferior Apophyſes, there is another ſmall Impreſſion, for the Inſertion of a tranſverſe Ligament, which ſecures the Axis in its Place. All round this Circumference, both toward its ſuperior and inferior Edges, there are many other Inequalities or Impreſſions.

In new-born Children, this Vertebra has only the two lateral Pieces oſſified, the anterior Curvature, which it has inſtead of a Body, being cartilaginous. The ſecond Vertebra of the Neck

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is very different from the firſt; its Body is narrower and longer than that of the following Vertebræ, and its Length is increaſed on the ſuperior Part by an Eminence like a Pivot, or Axis; called by the Greeks Odontoïdes, by the Latins Dentiformis or ſimply Dens.

In this Axis four Impreſſions or Marks are obſervable; one anterior, which is cartilaginous, for its Articulation, by a like Impreſſion, with the great Sciſſure in the firſt Vertebra; one poſterior, for the Inſertion of the tranſverſe Ligament; two ſuperior, which unite at the Point of the Axis, and ſerve for the Inſertion of the Ligaments, by which the Axis is faſtened to the anterior Edge of the Occipital Foramen. The ſuperior Portion of the Axis is a true Epiphyſis grafted upon a forked Apophyſis. The ſpinal Apophyſis, is ſhort, broad, and very much forked, being diſtinguiſhed into two lateral Parts by a Kind of angular Criſta. Its inferior Side is concave, and of an angular Cavity, which is divided into two lateral Parts, by an oſſeous Line.

The tranſverſe Apophyſes are very ſhort, a little inclined inferiorly, and perforated obliquely; whereas in all the other Vertebræ theſe Perforations are perpendicular. When the Apophyſes are thin, this Obliquity does not appear ſo much; but when they are thick, the Foramen is more like a true Canal, bent in ſuch a Manner, that one Orifice is inferior, the other externally. The Apophyſes themſelves terminate in a Point turned downward.

The ſuperior articular Apophyſes do not anſwer exactly to the inferior Apophyſes of the firſt Vertebræ. Their cartilaginous Sides are inclined obliquely, externally, and inferiorly; and as they are narrower than the former, and have their Margins more raiſed toward the exterior Side, a ſmall

empty Space is commonly left between the two, on the pofterior and anterior Parts in the Skeleton: The Reafon of which fhall be demonftrated in the next Lecture.

The fuperior Apophyfis of this Vertebra, the tranfverfe Proceffes of the firft, and their Foramina, are all in the fame perpendicular Line.

The inferior Apophyfes are lefs, and fituated more pofteriorly; their cartilaginous Sides are turned in the fame Manner very obliquely, inclined from the inferior to the fuperior, and from the anterior to the pofterior; fo that their Situation is more vertical than horizontal. They are likewife a little concave.

The fuperior Sciffures are fuperficial, long, fituated behind the fuperior Apophyfes, and infenfibly difappear, toward the fpinal Apophyfes. The inferior Sciffures are fituated more forward directly under the tranfverfe Apophyfes of their Foramina. The Body of this Vertebra has a very fmall Tubercle anteriorly.

This fecond Vertebra confifts at the Birth of four Pieces: for befides the three which I already mentioned, as common to all the Vertebræ, the Odontoïd Procefs of this Bone is begun at this Time to be offified in its Middle, and is joined as an Appendix to the Body of the Bone *.

The Conformation of the third cervical Vertebra is not very different from the reft in general, already defcribed.

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* Here we may deduce one good Reafon, why Nurfes ought to keep the Heads of new-born Children, from falling too far backwards, by ftay Bands, or fome fuch Bandage, till the Mufcles attain Strength fufficient to prevent that dangerous Motion. MONRO, on the Bones.

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The ſuperior Apophyſes anſwer to the inferior of the ſecond Vertebra, their cartilaginous Sides being a little convex and turned poſteriorly. The inferior Apophyſes are a little concave and turned anteriorly.

The tranſverſe Apophyſes are very ſhort, and ſituated before the articular ones.

They are ſomething forked and depreſſed on the ſuperior Side, between the lateral Aperture and the Extremity. The Sciſſures are turned a little anteriorly, above and below the tranſverſe Apophyſes, and the inferior are deeper than the ſuperior.

The fourth, fifth, and ſixth Vertebræ are like the third, except that their Bodies are gradually more extended, but ſtill concave on the ſuperior Surface, and convex on the inferior; and that the ſpinal Apophyſis of the ſixth Vertebra is longer, thinner, and ſtraiter, than the three above it.

The inferior Apophyſes, of the fourth and fifth Vertebræ, and the ſuperior of the ſixth, are not ſo much inclined as thoſe above them.

The Body of the laſt cervical Vertebra is the largeſt of all, ſo as has been already obſerved, all the ſeven repreſent a Sort of Pyramid ſet on the vertebral Pillar of the Back; the inferior Side of the Body of this Vertebra is almoſt flat.

The ſpinal Apophyſis is long, almoſt ſtrait, and very prominent; for which Reaſon it has been termed Prominens in Latin. It ends in a little flat Head, ſometimes a little depreſſed or forked.

The tranſverſe Apophyſes of this Vertebra are longer, ſituated more poſterior and leſs grooved than the former. Their Foramina are ſometimes double, and in that Caſe leſs than when they are ſingle, and ſometimes there is an Aperture

in them like a Sciffure, which Variety is alfo obfervable in the fixth.

The fuperior Apophyfes, are like thofe of the other Vertebræ; but in the inferior, the Sides are more inclined and broader, anfwerable to the fuperior Apophyfes of the firft Dorfals.

In the fix inferior cervical Vertebræ the middle Foramina are much larger than in the Dorfals. They are in fome meafure triangular, being broad on the anterior Side, and contracted on the pofterior.

Of the Dorsal Vertebræ.

They are twelve anteriorly, which may be diftinguifhed from the other by the following Marks.

The Bodies of the Dorfals are longer than thofe of the Cervical, and in all of them (except the firft, the fuperior Side of which is a little concave) both fuperior and inferior Sides are equally flat; this flatting on their Sides, which makes the Figure of the Vertebræ almoft femi-oval, which affords a firmer Articulation to the Ribs, allows the Trachea Arteria to divide at a fmaller Angle, and the other large Veffels to run fecure from the Action of the vital Organs.

Thefe Bodies are more concave behind than any of the other two Claffes. Their fuperior and inferior Surfaces are horizontal.

The oblique Proceffes are placed almoft perpendicular, the fuperior flanting but a little anteriorly, and the inferior as much pofteriorly. Neither they, nor the oblique cervical Proceffes have as much Convexity or Concavity as is worth remarking. A fmall Roughnefs is obfervable at their Roots, where the

the Ligaments that ſurround their Articulations are inſerted.

Between the oblique Proceſſes of the oppoſite Sides, ſeveral acute Proceſſes project from the ſuperior and inferior Parts of the Laminæ, which join to form the ſpinal Proceſs; into theſe ſharp Proceſſes, ſtrong Ligaments are fixed for connecting the Vertebræ.

The tranſverſe Proceſſes of the dorſal Vertebræ are long, thicker at their Extremity than in the Middle, and turned obliquely backward, which may be owing to the Preſſure of the Ribs, the Tubercles of which are inſerted into a Depreſſion near the Extremity of them.

The ſpinal Proceſſes are long, ſmall pointed, and run ſloping inferiorly and poſteriorly; from the ſuperior Part of their poſterior Surface, a ſmall Ridge ariſes, which is received by a ſmall Canal in the anterior Surface of the ſpinal Proceſs, immediately above, which is connected to it by a Ligament. Hence but little Motion can be allowed of here, leaſt the Heart and Lungs ſhould be diſturbed in their Actions.

The Conduit of the Medulla Spinalis is here more circular, but correſponding to its Size, which is ſmaller than in any of the Vertebræ; and a larger Share of the Foramina, in the oſſeous Curvatures for the Tranſmiſſion of the Nerves, is formed in the Vertebra above, than that below.

The Bodies of the four ſuperior Dorſals deviate from the general Rule of the Vertebræ as they deſcend; for the firſt of theſe four is the largeſt, and the other three below gradually become ſmaller, to allow the Trachea and larger Veſſels to divide at ſmaller Angles.

The proportionable Magnitude of the two little Depreſſions in the Body of each Vertebra,

for receiving the Head of the Ribs seems to vary in the following Manner: The Depression on the superior Margin of each of them decreases as far down as the fourth, and after that increases.

The transverse Processes, are longer in each inferior Vertebra to the seventh or eighth, with their smooth Surfaces, for the Tubercles of the Ribs, facing gradually more inferiorly; but afterward as they descend become smoother, and the smooth Surfaces are directed more superiorly.

The Spinal Processes of the dorsal Vertebræ become gradually longer, and more slanting, from the first as far down as the eighth or ninth Vertebra, from which they manifestly return shorter and more erect.

The inferior articular Surface of the last Dorsal faces laterally externally, in order to be received into the superior articular Surface of the first lumbal Vertebra.

The eleventh often has the whole Cavity for the eleventh Rib in its Body, and wants the smooth Surfaces on each transverse Process.

The twelfth always receives the whole Head of the last Rib, and has no smooth Surface, its transverse Processes being very short.

Of the Lumbal Vertebræ.

They are Five which may be also distinguished from any others by these Marks, viz. First, Their Bodies, though of a circular Form, at their anterior Part, are somewhat oblong from one Side to the other, which may be occasioned by the Pressure of the large Vessels in embryo State, and of the Viscera contiguous to them. The Epiphyses on their Margins are larger, therefore the superior and inferior Surfaces of their Bodies are more concave than in those of the Dorsals.

Second,

Secondly, The Cartilages between the Vertebræ are much the thickeſt of any, and render the Spine convex within the Abdomen, by their greateſt Thickneſs at their anterior Part.

Thirdly, The oblique Proceſſes are ſtrong and deep; thoſe in the oppoſite Sides being almoſt placed in parallel Lines, the ſuperior (which are concave) facing the internal; and the convex inferior ones the external; therefore theſe Vertebræ receive each other above, and are received below, which is not ſo evident in the other two Claſſes already deſcribed.

Fourthly, Their tranſverſe Proceſſes are ſmall, long, and almoſt erect, for allowing a ſufficient Motion to each Bone, and Inſertion to the Muſcles; likewiſe, to ſupport and defend the internal Parts.

Fifthly, Betwixt the Roots of the ſuperior oblique and tranſverſe Proceſſes, a ſmall Protuberance may be obſerved, where the Muſcles that raiſe the Trunk are inſerted.

Sixthly, Their ſpinal Proceſſes are ſtrong, ſtrait, and horizontal, with broad flat Sides, and a narrow Margin above and below, this laſt being depreſſed on each Side by Muſcles. And at the Root of Margins, we ſee rough Surfaces for fixing the Ligaments.

Seventhly, The Canal for the Medulla Spinalis, which is divided here into a great Number of Nerves, is rather larger in theſe, than in the Dorſal Vertebræ.

Eighthly, The Foramina for the Paſſage of the Nerves are more equally formed from the contiguous Vertebræ than in others; the ſuperior one furniſhes, however, the larger Share of it.

Both the tranſverſe and ſpinal Proceſſes of the middle lumbal Vertebræ are longeſt and thickeſt; above and below as they diminiſh: So that

these Processes of the first and fifth are the least, which is very necessary, especially as to the transverse ones of these two Vertebræ; for if they had been long, they would have struck on the Ribs or the Ossa Ilium, or would have bruised the interposed Muscles, in the Deflexions of the Spine externally.

The Epiphyses are round the Margins of the Bodies of those Vertebræ mostly rising in the two inferior, which consequently make them appear hollower in the middle, than the others.

The Body of the fifth is rather thinner than that of the fourth. The spinal Process of this fifth is smaller, and the oblique Processes face more posterior and anterior than in any other lumbal Vertebra.

The true Vertebræ serve to give us an erect Posture; to allow a sufficient and secure Motion to the Head, Neck, and Body on all necessary Occasions; and to support and defend the Viscera and other soft Parts.

After considering the particular Structure of the Vertebræ, and their mutual Connection, we may observe a solicitous Care has been taken that they cannot be disarticulated, but with great Difficulty: For either their Bodies interfect so into each other, as to prevent their being easily displaced, as in the cervical Vertebræ; as their Bodies are proportioned on all Sides, those of the Back by the Ribs; and their Surfaces of Contact are so broad, and the Ligaments so strong, and firmly connected, as to render the Separation, almost impracticable as in the Loins; while the Depth and Articulation of the oblique Processes are exactly proportioned to the Motion, which the other Parts of the Bones will allow, or the Muscles can perform: Yet as these oblique Processes are small, and therefore not capable of

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ſo ſecure a Conjunction as the larger Bodies, they may ſooner be diſarticulated; but this would not be of near ſo bad Conſequence as the Separation of the Bodies: For the oblique Proceſſes being diſlocated, the Muſcles, Ligaments, and Medulla Spinalis, are extended; but the Medulla Spinalis muſt be compreſſed or intirely deſtroyed, when the Body of the Vertebra is removed out of its Place.

The FALSE VERTEBRÆ compoſe the inferior Pyramid of the Spine; they are different from thoſe already deſcribed by this Epithet of falſe, becauſe though each Bone reſembles the true Vertebræ in Figure, yet none of them contribute to the Motion of the Trunk of the Body, they being intimately united to each other, except at their interior Part, where they are moveable; whence they are commonly divided into two, Os Sacrum and Coccygis.

OS SACRUM is ſo called from being offered in Sacrifice by the Antients, or rather becauſe of its Largeneſs, in reſpect of the other Vertebræ. This Bone is of an irregular triangular Shape, broad above, narrow below, convex behind, for the advantageous Origin of the Muſcles that move, the Spine and Thigh poſteriorly, and concave before, for inlarging the Cavity of the Pelvis. In young Subjects, it may be eaſily ſeparated into five Portions; nay, in Adults, ſome Veſtiges * of this Diviſion are obſervable on its anterior Surface, and within the great Canal that runs through the middle of it; but on its poſterior Sides, there are no ſuch viſible Marks of a former Diviſion; however, we can diſtinguiſh each of them.

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* I have by me one from a Man about forty years of Age, in which theſe Portions are very diſtinct.

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The anterior ſpongy Part of the Os Sacrum, analogous to the Bodies of the true Vertebræ, is ſmooth and flat before, to allow a large Space for the contained Viſcera.

Its poſterior Part is almoſt ſtrait, as the Vertebræ: The Medulla Spinalis being here ſmall, is ſeparated into a Number of Nerves, called from their Appearance Cauda Equina, which a ſmall Canal can eaſily contain. The Curvatures, between the Bodies and Proceſſes of this Bone, are much thicker; and, in proportion, ſhorter than in the other Vertebræ.

The Strength of theſe tranſverſe Curvatures is very remarkable in the three ſuperior Bones, and is well proportioned to the incumbent Weight of the Body, which they ſuſtain when we are in an erect Poſture.

There are only two oblique Proceſſes of the Os Sacrum, one projecting on each Side from its firſt ſuperior Part. Their plane erect Surfaces are poſteriorly, and receive the inferior oblique Proceſſes of the laſt lumbal Vertebra, to which theſe Proceſſes are connected by a ſtrong Ligament, which riſes from a ſcabrous Cavity round their Roots, where mucilaginous Glands are alſo lodged.

The tranſverſe Proceſſes here, are all grown together into one large ſtrong oblong Proceſs on each Side; which anſwers to the firſt three Bones, and is very thick, and divided into two irregular Cavities, by a long perpendicular Ridge.

The tranſverſe Proceſſes of the two laſt Bones of the Os Sacrum are much ſmaller than the former.

The ſpinal Proceſſes of the three ſuperior of the Os Sacrum appear ſhort, acute, and almoſt erect; while the two anterior are open behind, and ſometimes a little Knob is to be ſeen on the fourth,

though generally it is bifurcated without the two Legs meeting into a Spine.

This Bone is articulated above to the laſt Vertebra of the Loins, in the ſame Manner as the lumbal Vertebræ are connected. Laterally, the Os Sacaum is joined to the Oſſa Ilium by Synchondroſis. Frequently theſe two Bones grow together in old Subjects.

The Uſe of the Os Sacrum is to ſuſtain the Spine, with all that belongs to it; and likewiſe contribute to form the Pelvis; its inferior Extremity is turned very far poſteriorly, and thereby the inferior Part is much inlarged: This Bone is ſtraiter in female than male Subjects. Laſtly, the whole Canal of the Spine, from the firſt cervical Vertebra to the Extremity of the Os Sacrum, may be looked on as an articulated Elongation of the Cranium, ſerving to contain a Production of the Brain called the Spinal Marrow; this Canal is larger in the Neck and Loins, than in the Back.

The lateral Foramina formed by the Sciſſures in each Vertebra tranſmit the ſame Number of Nerves.

This Bone in Infants conſiſts of three Pieces connected by Cartilages, as the Vertebræ; the poſterior Extremities of the two lateral Pieces being ſcarce contiguous in any of them.

Os Coccygis, ſituated at the Extremity of the Os Sacrum, is, in ſome meaſure, an Appendix thereof. Its Figure is ſomewhat like a Cuckoo's Bill, from whence it aſſumes this Name: The anterior Side is flat, and its poſterior a little convex. It is compoſed of four or five Pieces like falſe Vertebræ, connected with Cartilages more or leſs pliable. Sometimes theſe Pieces are intirely cemented together; in Children, very near the whole of it is Cartilage. The firſt Piece is the largeſt, and on each Side of its Baſis, there are ſometimes ſmall

Apophyſes

Apophyſes or Coruna, connected cloſely to the Extremity of the Os Sacrum; it has alſo ſometimes a kind of tranſverſe Apophyſes, with ſmall Sciſſures on their ſuperior Part, which, joining with thoſe in the laſt Piece in the Os Sacrum, form a Pair of Foramina, ſituated in the ſame Order with the other large ones. The other Pieces of the Os Occygis are a kind of irregular Squares, diminiſhing in Size as they deſcend, ſo that the loweſt is like a ſeſamoïd Bone. This Bone ſerves to ſuſtain the Extremity of the Inteſtium Rectum; and in order to perform this Office more effectually, it is made to turn with a Curve anteriorly, by which alſo the Bone itſelf, as well as the Muſcles and Teguments, are preſerved from any Injury, when we ſit with our Body in a reclined Poſture.

Mechanism of the Spine *.

The Articulations of the true Vertebræ of the Spine are plainly double; for their Bodies are joined by Synchondroſis, and their oblique Proceſſes are articulated by the third ſort of Ginglymus. Hence it is evident, that their Center of Motion, is altered in different Poſitions of the Trunk; for when we bow forward, the ſuperior moved Part bears intirely on the Bodies of the Vertebræ; if we bend back, the oblique Proceſſes ſupport the Weight; if we incline to one Side, we reſt upon the oblique Proceſſes of that Side, and Part of the Bodies; if we ſtand erect, all the Bodies and oblique Proceſſes have their Share in our Support. Hence it follows, Firſt, That becauſe the Articulations, of which the Spine is compoſed, are ſo numerous; the Medulla Spinalis, Nerves, ſanguinous Veſſels, &c. are not liable to ſuch

* From Monro on the Bones, with a little Alteration of the Language, &c. alſo the greateſt Part of this Lecture.

Compreſſion

Compreſſion and overſtretching in the Motion of the Body, as they would otherwiſe be, ſince ſeveral Vertebræ muſt be concerned in every Motion of the Spine; and therefore a very ſmall Curvature is made at the Conjunction of any two Vertebræ. Secondly, That an erect Poſture is the ſureſt and firmeſt, becauſe the Surface of the Contact of the Fulcra is largeſt, and the Weight is moſt perpendicular to them. Thirdly, That the Muſcles, which move the Spine, act with greater Force in bringing the Trunk to that Poſture, than in drawing it to any other: For in bending forward, backwards, or laterally, the Muſcles which perform any of theſe Actions are near the Center of Motion, conſequently the Lever with which they act, is ſhorter than when the Center of Motion is on the Part of the Vertebra, oppoſite to that where theſe Muſcles are inſerted, which is the Caſe in raiſing the Trunk. This is extremely well adapted, ſince, in the Deflections of the Spine, from a perpendicular Bearing, the Weight of the Body ſoon inclines it which way we deſign; whereas in raiſing us erect, this great Weight muſt be more than counteracted. Fourthly, In calculating the Force exerted by the Muſcles, which move the Spine, we ſhould, with BORELLI * and PARENT, † always make allowance for the Action of the Cartilages between the Vertebræ, which muſt, in every Motion from an erect Poſture, be extended on one Side, and compreſſed on the other, to both which they will reſiſt; whereas in raiſing the Trunk, theſe Cartilages will aſſiſt, by their Elaſticity. Fifthly, Hence we are led into the Reaſon of the Phænomenon obſerved by Mr. WASSE ‡. That our Height

* De Motu Animal. † Hiſtcrie del'Acad. des Scienes, 1702.
‡ Philoſoph. Tranſact.

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is increaſed in the Morning, and diminiſhed at Night; for the intermediate Cartilages of the Vertebræ being preſſed all Day long by the Weight of our Body, become more compact and thin in the Evening; but when they are relieved from this Preſſure in the Night, they again expand themſelves to their former Thickneſs; and ſeeing the Bulk of any Part muſt vary, according to the different Diſtention or Repletion of the Veſſels compoſing it, we may underſtand how we become taller after a plentiful Meal, and decreaſe after Faſtings or Evacuations, which Difference the Abbé FONTENU* has proved to depend moſtly, if not ſolely, on the different Thickneſs of theſe Cartilages. Sixthly, From the different Articulations of the Bodies, oblique Proceſſes of the Vertebræ, and the different Strength of the Ligaments, it is plain they are formed ſo as to allow a much larger Motion forwards than backwards; this laſt being of much leſs Uſe, might be dangerous, by overſtretching the large Blood Veſſels that are contiguous to the Bodies of the Vertebræ.

When we are acquainted with the Structure and Articulations of the firſt and ſecond Vertebræ, and know exactly the Strength and Connection of their Ligaments, there is no Difficulty in underſtanding the Motions that are performed upon or by the firſt, though this Subject was formerly Matter of warm Diſpute among ſome of the greateſt Anatomiſts. 'Tis to no Purpoſe we ſhould enter into a Detail of the Reaſons advanced by either Party, but to explain the Fact, as any one may ſee it, who will remove the Muſcles, which, in a recent Subject, hinder the View of theſe two Articulations, and then will turn the Head into all

* Hiſtorie de l'Acad. des Sciences, 1725.

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the different Pofitions it is capable of. The Head may then be feen to move forwards and backwards on the firft Vertebra, as has been already faid; while the Atlas performs the Circumgiration upon the fecond Vertebra, the inferior oblique Proceffes of the firft Vertebra moving eafily in a circular way, on the fuperior oblique Proceffes of the fecond; and its Body or anterior Arch having a Rotation on the Odontoïd Procefs, by which the perpendicular Ligament that is fent from the Point of the Odontoïd Procefs to the Occipital Bone, is twifted, while the lateral Ligaments that fix the Proceffus Dentatus to the Sides of the firft Vertebra, and to the Os Occipitis are very differently affected; for the one upon the Side towards the Face, by the Circumgiration, is much fhortened and lax, while the oppofite one is extended and made tenfe, and yielding at laft no more, prevents the Head from turning any further round on this Axis; fo that thefe lateral Ligaments are the proper Moderators of the Circumgiration of the Head here, which muft be larger or fmaller, as thefe Ligaments are ftronger or longer, and more or lefs capable of being extended. Befides the Revolution on this Axis, the firft Vertebra can move a fmall way to each Side, but is prevented from moving anteriorly and pofteriorly by its anterior Curvature and tranfverfe Ligament, which are both clofely applied to the Odontoïd Procefs.

The anterior Motion here would have been of very bad Confequence, as it would have brought the Beginning of the Medulla Spinalis upon the Point of the Odontoïd Procefs.

The rotatory Motion of the Head is of great Ufe to us on many Accounts, by allowing us fo quietly to apply our Organs of Senfe to Objects; and

and the Axis of Rotation was altogether proper to be at this Place; for if it had been at a greater Diſtance from the Head, and the Weight of the Head had at any time been removed from a perpendicular Bearing to the ſmall moveable Articulation, and thereby acquired a long Lever, it would, at every Turn inconſiderately performed, have broken the Ligaments; or they muſt have been formed much ſtronger than could have been connected to ſuch ſmall Bones: Neither could this circular Motion be performed on the firſt Vertebra without Danger, as the Medulla Oblongata adheres ſo cloſe to theſe Parts; and likewiſe the Medulla Spinalis, would have been in Danger of being contorted, and ſuffering by the Compreſſion this would have made on its tender Fibrils.

It is neceſſary to obſerve that the lateral or more moderate Ligaments confine the Motion of the firſt Vertebra upon the ſecond, that though this Articulation may ſerve us on ſeveral Occaſions, yet we are often obliged to turn our Faces farther round than this Joint alone can allow, without the greateſt Danger of twiſting the Spinal Marrow too much, and alſo of luxating the oblique Proceſſes; therefore in large Turns of this kind, the Rotation is aſſiſted by all the cervical Vertebræ and Lumbals; and if this is not ſufficient, we employ moſt of the Articulations of the inferior Extremities.

This Combination of a great many Connections towards the Performance of one Motion, is alſo to be obſerved, in ſeveral other Parts of the Body; notwithſtanding ſuch Motions are generally ſaid to be performed by ſome ſingle Joint only.

Observation.

Ruysche (Obſervation lxvii.) ſays he has met with ſeven dorſal Vertebræ concerted together, which

which formed an Anchylosis, and curvated into a Circle, so that the Body of the superior Vertebra unites with that of the inferior. The Bodies of four of these Vertebræ scarce formed the Thickness of one.

I have by me, eight dorsal Vertebræ, from an old Subject, ossified together, but not much curvated.

Therefore it is easy to account for the crooked Spine, or hump-backed People as they are commonly called.

Some crooked Spines being so formed in the Womb, by the curved Posture of the Fœtus; at which Time, the Ligaments and Cartilages contract so much as to remain always in that State; others contract by the different Attitude of Pressure, or in Persons, whose Occupation obliges them to remain in the same Posture, or as we observe old Persons, when the Cartilages lose their Elasticity.

LECTURE VII.

Of the THORAX.

THE Bones, which form the Thorax, are twelve Dorſal Vertebræ, and commonly twenty four Ribs, viz. twelve on each Side. Theſe Numbers vary ſometimes on both; they are diſguiſhed into true and falſe Ribs: And alſo a Bone called the Sternum.

The ſeven ſuperior Ribs on each Side go to the Sternum, and thus form an intire Curvature; for which Reaſon they are named true Ribs. The five inferior, which do not reach the Sternum, or form intire Arches, are termed falſe Ribs.

In each Rib, we may conſider, in general, its middle Part or Body; two Extremities, one anterior, the other poſterior; two Sides one external and convex, the other internal and concave; two Margins, one ſuperior, and the other inferior; and two Labia in each Margin, one external, the other internal.

The poſterior Extremity, which may be called the Head of the Rib, is articulated with the Dorſal Vertebræ. At the anterior Extremity, of which freſh Ribs are lengthened by cartilaginous Epiphyſes fixed into their oſſeous Extremities. This Production is termed the Cartilage, or cartilaginous Portion of the Rib.

Each

Each true Rib, at the posterior Extremity, has two small cartilaginous Impressions, distinguished by a kind of Angle, by which they are articulated with the lateral cartilaginous Impressions in the Bodies of the two Dorsal Vertebræ; but the first Rib has but one such Impression, being articulated with one Vertebra only.

At a small Distance from the Head of this Extremity, posteriorly, is another cartilaginous Impression on each Side, a little convex, and closely connected to a small Tuberosity. By these, the Ribs are articulated with the cartilaginous Depressions in the transverse Apophyses of the Dorsal Vertebræ; and the Tuberosities serve for the Insertion of Ligaments. The Portion, which lies between the Head and these Impressions, is contracted, and represents a Cervix.

When the posterior Extremity of a Rib is articulated with two Vertebræ, the second Articulation is always with the transverse Process of the inferior of the two.

Between the Tuberosity and middle Part of the Ribs exteriorly, there is on most of them, a kind of oblique rough Angle of different Breadth. In the first Rib, this Angle is not distinct from the Tuberosity. In the second, it reaches but to a small Distance from it. In the third, this Distance is greater, and thence continues to increase gradually all the Way to the third false Rib; so that if we look directly at the Back of a Skeleton, these Angles seem to represent the two Legs of a pair of Compasses opened pretty wide.

The Ribs interiorly, towards the inferior Margin, have a Sciffure reaching from the Angle, all the way to the Extremity, and that chiefly in the five inferior true Ribs, and the first three false ones. The superior Margin of the two first Ribs is acute; the inferior a little rounded. The superior Margin of the third is more obtuse,

and the inferior more flat. In the reſt, the ſuperior Margin is ſomewhat rounded, and the inferior more or leſs acute.

These Ribs increaſe in Length as they deſcend, and their anterior Extremities on each Side are at a greater Diſtance from one another; ſo that all the Extremities of one Side, with thoſe of the other, repreſent on the anterior Part of the Thorax, an Angle almoſt like that already taken notice of, on the poſterior Part. The Extremities of the firſt Ribs on each Side, do not lie in the ſame Line with the reſt, but being much ſhorter, are ſituated farther back; the ſame Thing is ſometimes, though very rarely, obſervable in the two ſecond Ribs. It is likewiſe peculiar to the firſt Rib, that its Breadth increaſes from the poſterior to the anterior Part.

In all the Ribs, the anterior Extremity is lower than the poſterior. The firſt inclines but little, the ſecond more, and the reſt as they deſcend; their anterior Extremities being proportionably at a greater Diſtance from each other, than the poſterior; the Spaces between which are every where nearly the ſame.

The Ribs are much more curved in the poſterior, than in the anterior Part. The Curvature of the two firſt, on each Side, lies almoſt in the ſame Line with the two Extremities of each. This Equality begins to be loſt in the third Rib, which is ſometimes diſtorted from the Angle all the way, to the anterior Extremity, the inferior Margin being turned a little externally, and the Curvature ſuperiorly about the middle of it, afterwards inferiorly, and thence to the anterior Extremity. This Diſtortion increaſes in the following Ribs, all the way to the third falſe Rib; all which look like a Italic *S*, and when laid on an even Table,

Table, one Extremity is always turned ſuperiorly, the other inferiorly.

The Appendices, Epiphyſes, or cartilaginous Portions of the true Ribs increaſe in Length, as they deſcend, in the ſame Manner as the Ribs themſelves.

Each of them, except the firſt, terminates by two cartilaginous Sides, connected by an Angle, by which they are articulated with the Sternum, by a Symphyſis, like that which connects with the other oſſeous Extremity of the Ribs.

The Cartilages of the firſt three or four Ribs, are nearly in the ſame Direction with the Ribs themſelves. In the Ribs below theſe, the Cartilages make Angles, at which they turn ſuperiorly toward the Sternum, and this Curvature increaſes in proportion as the Ribs deſcend. The inferior Cartilages, in changing their Direction ſuperiorly, lie very cloſe to each other, and thoſe of the laſt two true Ribs, have often at their inferior Margin, a ſort of Apophyſis or Production, by which they are connected with the Cartilages immediately below them. The laſt two true Ribs extend conſiderably in Breadth towards their inferior acute Margins, from the Angle for ſome Diſtance anteriorly. Afterwards they contract in Breadth, and increaſe in Thickneſs, forming a ſort of Cervix a little longer than that at their poſterior Extremities. In all the Ribs, this Extremity terminates in a Cavity in which the Cartilages are inſerted.

The three ſuperior falſe Ribs increaſe anteriorly in Breadth from the Angle in the ſame Manner as already ſaid. Their Sciſſures are moſt conſiderable. They have Heads, Necks, Tuberoſities, and Angles, almoſt the ſame as in the laſt true Ribs. Their Length diminiſhes by degrees, and their anterior Extremities ſeparating from each other in the ſame Manner, with thoſe of the true Ribs, lie in the ſame Line with them. The laſt two have

only one Impreſſion at their poſterior Extremities, and are without any Tuberoſity.

They are both much ſhorter than the reſt, eſpecially the fifth. All the falſe Ribs have cartilaginous Appendices. The firſt is longeſt and fixed to the Cartilage of the laſt true Rib. The two following are united at their Extremities. The laſt two are connected only to Muſcles and Ligaments. They are both very ſhort, eſpecially the laſt, which is not above a Quarter of an Inch in Length. All theſe Cartilages of the falſe Ribs are pointed at their Extremities.

The Ribs are articulated anteriorly with the Sternum, and poſteriorly with the Vertebræ of the Back. The firſt Rib is entirely united with the Sternum, by means of its Cartilage. In the Six following, the Extremities of the Cartilages, connect that Bone.

The three ſuperior falſe Ribs, are connected to each other by the Extremities of their Cartilages; and the firſt is likewiſe connected to that of the laſt true Rib. The two laſt have no ſuch Connection.

The Connection of the Ribs with the Dorſal Vertebræ is moſtly by a Ginglymus. The firſt Rib on each Side is articulated by its Head, with the lateral Impreſſion in the Body of the firſt Vertebra, and by its Tuberoſity, with the ſmall Cavity in the tranſverſe Apophyſis of the ſame Vertebra.

The ſecond Rib is articulated by its Head with Impreſſions, in the inferior Part of the Body of the firſt Vertebra, and ſuperiorly to the Body of the ſecond; and by its Tuberoſity, with the articular Cavity, in the tranſverſe Apophyſis of the ſecond.

All the other Ribs, except the two laſt of the falſe ones, are articulated in the ſame Manner; that is by their Heads, with the Impreſſions on the Bodies of two Vertebræ next each other; and

by their Tuberofities, with the tranfverfe Apophyfis of the inferior of each two Vertebræ.

The eleventh and twelfth Ribs, are commonly articulated by their Heads only, with the Impreffion in the Body of one Vertebra.

From what has been faid, it is evident, that the ten fuperior Ribs, are confined to two Motions, one fuperiorly, the other inferiorly; whereas the two laft are left more at Liberty, and are therefore termed floating Ribs.

The Ribs adhere to the Dorfal Vertebræ and Sternum, and form a Cavity capable of Expanfion and Contraction, in which are contained chiefly the Organs of Refpiration, and thofe of the Circulation of the Blood. The Mechanifm of their Structure fhall be fpoken of hereafter.

All the Ribs in new-born Infants are complete, only their Cartilages are proportionally longer than in adult Subjects.

Of the Sternum.

The Sternum is fituated almoft perpendicularly on the anterior Part of the Thorax.

It is a long flat Bone not all of the fame Breadth.

This Bone is articulated by Synchondrofis to the feven fuperior Ribs, unlefs when the firft Part coalefces by an intimate Union of Subftance and is connected with each of the Clavicles, by a Ginglymus of the fecond Kind.

It is generally compofed of three principal Pieces; the firft broad and fhort; the fecond longer and narrower, the third a Sort of fmall Appendix, called by the Greeks Xiphoïdes, from its fomewhat Refemblance to the Point of a broad Sword.

The firft or fuperior Portion is broad and thick at the Top, but thinner and narrower below, being nearly of the Figure of a Triangle, with the three

Angles cut off, or of an irregular Square. We diſtinguiſh it into two Sides, one external or anterior, the other internal or poſterior; four Margins, one ſuperior, two lateral, and one inferior; and four imperfect Angles, two ſuperior, and two inferior.

The anterior or exterior is unequally convex, the poſterior or inferior Side, a little concave.

The ſuperior Margin is the thickeſt, with a large ſmooth Sciſſure in the Middle called by the ancients, the Furca. The two ſuperior Angles are two large, thick, articular Sciſſures, ſituated obliquely, on each Side of the Furca. The lateral Margins are thin and oblique, and in each of them we ſee an oblong cartilaginous Mark of the firſt true Rib. The two inferior Angles are two articular Semi-Sciſſures, which receive the Cartilage of the ſecond Rib. The inferior Margin is ſmaller and thicker than the others, being connected by a Symphyſis to the ſecond Portion.

The ſecond Portion of the Sternum is much longer than the firſt. It is flat on both Sides, and broader inferiorly than ſuperiorly. We obſerve in it ſometimes, eſpecially anteriorly, ſeveral tranſverſe Lines, which index the Places, where the Parts of which it is compoſed in Children, are united. Both Sides are flat, but depreſſed more or leſs, through the Middle of their whole Length. The ſuperior Margin is ſmall, being proportioned to the inferior one of the firſt Portion, with which it is connected by a cartilaginous Symphyſis. The inferior Margin is ſtill ſmaller, appearing like a truncated Angle.

The two lateral or greateſt Margins have each a cartilaginous Semi-Sciſſure, and five cartilaginous intire Sciſſures. The Semi-Sciſſures are ſuperiorly of the lateral Margins where they meet the Semi-Sciſſures in the firſt Piece.

The

The five intire Sciſſures come nearer to each other in Proportion as they are lower, and the laſt Part often belongs to the third Portion.

The third commonly called Cartilago Xiphoïdes, or Enſiformis, is entirely cartilaginous in young Subjects; but in advanced Age it generally oſſifies, either wholly or partly; in ſome Subjects later than in others: it would therefore be more properly named Appendix Xiphoïdes or Enſiformis.

This Portion is articulated to the inferior Extremity of the ſecond, between the Cartilages of the laſt true Ribs; and is often more or leſs ſciſſured on each Side, to form Part of the laſt articular Sciſſures of the Sternum. But neither its Figure nor Size are conſtant. In ſome Subjects, it is forked, in others perforated. Sometimes it is very large, ſometimes very ſmall, hardly exceeding the third Part of an Inch.

From different Directions of Oſſification of the Enſiformis, ariſe ſometimes great many Inconveniences: Particularly, when the inferior Extremity is intirely indurated and turned internally, or the Conjunction with the Sternum too looſe.

Rolfincius * relates, that an old Man, who could not bend his Body anteriorly, without a violent pungent Pain from the Oſſification of the accute Apex of the † Xiphoïdes. Paaw, ſays, that he has ſeen Inſtances of a Difficulty of Breathing, from the ſame Oſſification of the Enſiformis, he enumerates ſeveral Diſeaſes that may ariſe from it, ſuch as Phthiſis, Pulmonalis, Obſtructions of the Spleen, Liver, or Meſentery, which is cauſed by the internal Curvation of the Enſiformis.

The interior Subſtance of the Sternum, is almoſt cellulous and very ſlender, and covered externally, with a thin compact Lamellæ.

It completes the anterior Part of the Cavity of the Thorax; and ſuſtains the anterior Extre-

* Differt. Anatom. † De oſſibus.

mities

mities of the Ribs; being sufficiently fixed to resist Compressions, and other external Accidents; and yet moveable enough, by Means of its Articulation, with the Cartilages of the Ribs, not to obstruct the Motions necessary for Respiration. It likewise serves for the Insertion of several Muscles, and to support the Mediastinum, &c. as also to defend the vital Organs, Heart, and Lungs, anteriorly; and, lastly, as a moveable Fulcrum to the Ribs, in Respiration.

Of the Claviculæ.

The Claviculæ * and the Scapulæ are generally comprehended by Anatomists as Parts of the superior Extremities; but they appear to me, more properly to belong to the Trunk. They are situated transversly, and somewhat obliquely in the superior and anterior Part of the Thorax, between the Apophysis of the Scapula and the Sternum. It is long and incurvated in the Form of a Roman ∽ placed horizontally; convex before next to the Sternum, and concave towards the Acromium. This Bone is straiter in female than male subjects. It is divided into a Body or middle Portion, and two Extremities, one anterior, inferior, and internal, which I term the pectoral or sternal Extremity; the other posterior, superior and external, which Winslow named the humeral or scapular Extremity.

The pectoral Extremity is the thickest, and of a triangular Figure, especially near the End, where it is a little inlarged, and shews a cartilaginous Surface, with three Angles †, of which the

* So called from Clavis; being the Figure of a Key, among the Romans.

† Sometimes the superior Angles of this Surface are wanting.

loweſt is the moſt prominent, and turned a little toward the Cavity of the Thorax.

Near theſe Angles, there are ſeveral muſcular ligamentary Impreſſions; one of which, near the inferior Angle, is ſometimes raiſed like a Tubercle.

The humeral Extremity is flat and broad, and two Sides may be conſidered in it; one ſuperior, the other inferior; likewiſe two Margins, one anterior, the other poſterior; and a ſmall articular Surface.

The ſuperior Side has ſeveral Inequalities, and in the inferior, there is a Kind of oblong rough oblique Tuberoſity. The poſterior Margin is convex, thick, and uneven, being that of the ſmall Curvature of the Clavicula. The anterior Margin is concave, narrow, and ſmooth, every where, except near the great Curvature, where it has a rough Impreſſion. The articular Surface terminates this Extremity, being cartilaginous, turned obliquely forward, and of an oval Figure, like that of the Acromium, with which it is articulated. The Subſtance of this Bone is the ſame as other cylindrical long ones. It is articulated with the Acromium and Sternum, by Arthrodia, or what MONRO calls the ſecond Species of Ginglymus.

The Articulation with the Scapula by Means of the Acromium, is as real and diſtinct as the Articulation with the Sternum; which laſt appears ſomething extraordinary in the Skeleton, where the ſmall Sciſſure in the Sternum is no ways proportioned to the broad Extremity of the Clavicula.

The Claviculæ of Infants are not deficient in any of their Parts, nor have they any Epiphyſes at their Extremities, as moſt other ſuch long Bones have, which preſerves them from being inflected

inflected too much, and from the Danger of any unoſſified Parts being ſeparated by the Force which pulls the Arms anteriorly.

The Claviculæ ſerve for Buttreſſes to the Scapula, and limit their Motions anteriorly and ſuperiorly; by their ligamentary Connections, they likewiſe hinder the Scapulæ, from running too much poſteriorly; which might happen in thoſe who drag Burdens behind them, &c. They alſo give Inſertion to many Muſcles.

Of the Scapula.

The Scapula, called alſo Omoplata, is a large Bone of a triangular Figure, ſituated laterally at the ſuperior and poſterior Part of the Thorax, from about the firſt Rib down to the ſeventh.

It may be divided into two Sides, one external or poſterior and convex; the other internal or anterior and concave; three Margins, the one named the Baſis, and two named Coſtæ, one ſuperior, the other inferior; three Angles, one anterior, called the Head or Neck, one ſuperior and one inferior. I ſhall begin with the Margins and end with the Sides.

The Baſis is the longeſt Margin of the Scapula. It is commonly ſituated on one Side of the Spine, a little obliquely, the ſuperior Part of it being nearer the Vertebræ, than the inferior. It is, as it were, divided into two Parts, by a very obtuſe Angle, which diſtinguiſhes the ſuperior Quarter from the three other Quarters. It is conſiderably thick, and is accordingly divided into two Labia, one exterior, the other interior. It continues to be an Epiphyſis in many adult Subjects, towards both its Extremities, eſpecially towards the inferior.

The

The ſuperior Coſta is the ſhorteſt and thinneſt of the three Margins. It is ſituated almoſt tranſverſely between the ſuperior Point of the Baſis and Cervix of the Scapula, being a little more raiſed toward the Baſis, than at the other End, where it often terminates by a ſmall Sciſſure. It is divided into an internal and external Labium.

The inferior Coſta is of a middle Length, between the other two Margins. Its Situation is very oblique, between the inferior Point of the Baſis and Cervix of the Scapula. It is thicker than the reſt, and often appears to be double, having two very diſtinct Labia, the exterior of which is thin, the other round. Theſe two Labia are ſeparated by a Kind of Canal or Sulcus; and upon the external Labium, is a narrow Impreſſion which runs from the Cervix, through two thirds of the Length of the Coſta.

The Cervix of the Scapula, is the biggeſt of the three Angles. It ought more properly to be called a Head with a very ſhort Neck; and a ſuperficial or glenoïd Cavity, in the Top of it, which is lined with a Cartilage, and of an oval Figure, but pointed at the ſuperior Part, and rounded at the inferior; and deeper in the natural State, than in the Skeleton. In the natural Situation of the Scapula, this Cavity is turned obliquely forward, and not directly exteriorly. Between the Margin of this Cavity, and the contracted Part, which is the true Cervix, ſome Inequalities are obſervable, which are the Remains of Oſſification of the Symphyſis.

At the ſuperior Part of the Cervix, there is a Production or Epiphyſis, reſembling a crooked Finger or Crow's Bill, called the Coracoïd Apophyſis or Epiphyſis, which, at its Origin, has a Tuberoſity, for the Inſertion of the Ligaments of the Clavicle. It terminates by three muſcular

lar Impreſſions, which altogether form an obtuſe Point.

The Angles next the Baſis have nothing very remarkable, only that the ſuperior is more acute than the inferior in ſome Subjects.

The exterior Side of this Bone is unequally convex, and a little below the ſuperior Coſta, ſhews a long, high, thin Eminence, called the Spine of the Scapula, which riſes gradually higher from the Curvature, or obtuſe Angle, at the Baſis, all the Way to the Cervix, and afterward turns ſuperiorly and anteriorly over the coracoïd Apophyſis, forming another broad Apophyſis, called the Acromium. The Name of Criſta is given to the Margin of this Spine.

This Criſta is extended in Breadth, in three particular Places. The firſt is near the Baſis of the Scapula, where there is a ſmooth triangular Surface. The ſecond is a kind of oblong, flat, and rough Tuberoſity. The third is at the Acromium, already mentioned. On the anterior Margin of this Apophyſis, near its Point, is a ſmall cartilaginous Apophyſis for the Articulation of the Scapula with the Clavicula.

The Body of the Spine divides the external Side of the Scapula in two Portions; the ſuperior is leaſt, and termed Foſſa ſupra Spinalis; the inferior and largeſt, Foſſa ſub Spinalis; in which we obſerve a long Depreſſion lying a little above the Coſta Inferior; and running from the inferior Angle, we likewiſe meet with a Kind of ſmall diſtinct Surface unequally triangular and oblong, which aſcends on the inferior Coſta, towards the Sinus in its external Labium.

The interior Side of the Scapula is irregularly concave, chiefly ſuperiorly, and in a Manner divided into ſeveral ſuperficial and longitudinal Foſſulæ, by little Ridges, which run like

Radii

Radii from the Cervix toward the Basis. The Direction of these Lines is transverse, with respect to that of the Ribs.

Besides these Parts, we observe likewise three Scissures, one very large between the Cervix and the Spine, one small, between the superior Costa and the coracoïd Apophysis, and one of a middle Size, between that Apophysis and the glenoïd Cavity. There is sometimes a particular Foramen, which either perforates the Basis of the Spine at its Middle, or is there lost in the Substance of the Bone.

Here are two small rough Marks, which are muscular Impressions of the Cervix of the Scapula, immediately above, and below the glenoïd Cavity; the inferior of which extends itself a little over the adjacent Costa.

In the Cervix, Spine, Basis, inferior Costa, and coracoïd Process, there is a Diploë; the rest of the Bone is thin, transparent, and almost without any intervenient cellulous Substance.

The Scapula is articulated with the Clavicual and the Acromium, with the Humerus, by the glenoïd Cavity. It is likewise connected to the Trunk by Syssacorsis.

The Basis, Acromium, coracoïd Process, and Head of the Scapula are all in a cartilaginous State at the Birth, and the three first are articulated as Epiphyses; while the Head, with the glenoïd Cavity, is not formed into a distinct separate Bone, but is gradually produced by the Ossification of the Body of this Bone, being continued anteriorly.

The Use of the Scapula is to serve as a Fulcrum to the Arm; and by altering its Position, on different Occasions, to allow always the Head of the Humerus a right situated glenoïd Cavity to move in, and thereby to assist and to inlarge

greatly

greatly the Motions of the superior Extremity, and to afford the Muscles, which rise from it, more advantageous Actions, by altering their Directions, to the Bone which they are to move.

This Bone also serves to defend the posterior Part of the Thorax, and is often employed to sustain Weights, or to resist Forces too great for the Arm to bear.

Of the Pelvis.

The Pelvis consists of three Bones, viz. two Offa innominata, and the Os sacrum, which last is already described.

The Offa innominata (so improperly named,) have always retained three distinct Names, as being three separate Bones in Infants; connected by a Cartilage, which afterwards perfectly offesies, having commonly no Vestige of the first Division.

Anatomists, however, consider it, even in Adults, as three different Portions, and distinguish them by different Names, as if they were three distinct Bones.

Of these three, the largest is the superior, posterior, called Os Ilium; the second, inferior, Os Ischium; the third and smallest anterior Os Pubis.

Before we treat of each of these Portions separately, it must be observed, that in the intire Bone, there are several common Parts, which belong to more Portions than one, viz. a deep cartilaginous Cotyloïd, or Acetabulum, formed by these three Portions: a large Opening, called Foramen Ovale, which, from its Resemblance to a Shield, has been also named Thyroïdes, formed by the Offa Ischii, and Pubis: a larger posterior Sciffure or Sinus, called the Ischiatic Sciffure

or

or Sinus, formed by the Os Ilium and Os Iſchium: an oblique Eminence or Protuberance above the Acetabulum, toward the Foramen Ovale, made by the Oſſa Ilium and Pubis.

To theſe may be added a Ridge on the Inſide of the Pelvis, which divides the ſuperior Part from the inferior, to which alone the Antients gave the Name of Pelvis.

Of the Ossa Ilii.

The Os Ilium was ſo named by the Ancients, becauſe it ſupports the Parts called by them Ilia.

This Bone is the largeſt of the three. It is flat, very broad, unequally convex and concave, partly round, and partly of an irregular ſquare Figure.

It is divided into the Criſta, Baſis, anterior and poſterior Margins, and two Sides, one external, the other internal.

The Criſta is the ſuperior Part, being a pretty thick arched Margin; the Circumference of which is a little more than the Quadrant of a Circle. The anterior and middle Parts are externally convex, the poſterior a little convex interiorly. We obſerve in it two Labia, and a middle Space, or Interſtice between them. It is originally an Epiphyſis, the Marks of which are ſometimes very conſpicuous even in advanced Age.

The poſterior Portion of the Criſta, which is interiorly convex, is much thicker than the anterior, and for that Reaſon might be called the Tuberculum of the Criſta. The whole Criſta appears to be cruſted over with a Cartilage, which in Reality is no more than the dried tendinous Inſertions of the Muſcles.

The anterior Margin of the Os Ilium, has two Eminences or Tubercles, called the anterior Spines; one ſuperior, the other inferior; and likewiſe two

 Sciſſures,

Sciſſures, one between the Spines, the other below the inferior Spine.

The poſterior Margin is ſhorter and thicker than the anterior. It terminates likewiſe in two Eminences or Spines, between which there is a conſiderable Sciſſure.

The Baſis, or inferior Part, of this Bone is the thickeſt and narroweſt of all. It forms anteriorly a Portion of the Acetabulum, and poſteriorly almoſt all the Iſchiatic Sciſſure.

The exterior Side is convex anteriorly, and concave poſteriorly. We obſerve on it the Remains of a long ſemicircular Line, which reaches from the ſuperior anterior Spine, to the great Iſchiatic Sinus, being a muſcular Impreſſion. Above and behind this Semicircle, there are ſeveral other Marks and muſcular Impreſſions. A little above the Margin of the Acetabulum, we ſee likewiſe many Inequalities, which ſurround Part of that Margin in a ſemicircular Form, being a Collection of muſcular and ligamentary Marks.

The interior Side is unequally concave, and has ſeveral Inequalities toward the poſterior Part, the chief of which is, that large cartilaginous Surface, of the Figure of an S, or of a Bird's Head, which anſwers to the lateral Surface of the Os Sacrum, with which it is connected by a cartilaginous Symphyſis.

The other Inequalities are much of the ſame Kind with thoſe in the lateral Part of the Os Sacrum, with which they form ſeveral rough and irregular Cavities. From the ſuperior Part of the cartilaginous Surface or Symphyſis, all the Way to the oblique Eminence, runs a prominent Line, which bounds the Cavity of the Inſide of this Bone, and diſtinguiſhes the Margin of the Pelvis from its inferior Portion.

OF

Of the Ossa Ischii.

The Os Ischium is the inferior Portion of the Os Innominatum, as well as of the whole Trunk. It is divided into Body, Tuberoſity, and Ramus or Branch.

The Body of the Iſchium forms the inferior and greateſt Portion of the Acetabulum, and ſends out an Apophyſis poſteriorly, called the Spine of the Iſchium.

The Tuberoſity is very thick, unequal, and turned inferiorly; and it is on this Part that the whole Body reſts, when we ſit. It appears cartilaginous, becauſe of the dried and hardened remains of the Tendons. The whole convex Portion of it is originally an Epiphyſis, of which the Marks are obliterated ſooner, in ſome Subjects, than in others.

The Branch of the Iſchium is a Kind of ſmall, flat, thin Production, or Apophyſis, which aſcends anteriorly from the Curvature of the Tuberoſity to the Pubis; and is often covered in Part by a Continuation of the Epiphyſes of its Tuberoſity.

Theſe three Parts of the Iſchium, taken together, form a large Opening, which makes the greateſt Part of the Foramen Ovale. Three other Sciſſures are remarkable upon this Bone; one poſterior, between the Tuberoſity and the Spine, for the Paſſage of the internal Obturator Muſcle, which is ſomewhat cartilaginous, and divided into three or four ſmall ſuperficial Canals; one lateral, between the Tuberoſity and the Acetabulum, for the Paſſage of the external Obturator Muſcle; and one anterior at the Margin of the Acetabulum for Ligaments, &c.

Of the Ossa Pubis and Acetabulum.

The Os Pubis is the least of the three Portions of the Os Innominatum. The two together form the anterior Part of the Pelvis; and in each we may distinguish the Body, Angle, and Branch.

The Body of the Os Pubis is superiorly situated transversly before the inferior Part of the Os Ilium. Its posterior Extremity is very thick, and by the Union with the Ilium, forms the oblique Eminence, which distinguishes these two Portions of the Ossa Innominata. It likewise contributes to the Formation of the Cotyloïd Cavity. Its anterior Extremity terminates in a small Eminence or Tuberosity, called the Spine of the Os Pubis, which is sometimes double.

The superior Margin has interiorly an oblique Ridge; which may be called the Crista of the Os Pubis, and is continuous with that Ridge which distinguishes the Margin from the inferior Part of the Pelvis. Before this Crista, is a broad, oblong, and oblique Slope. The inferior Margin is obliquely scissured, and forms the superior Part of the Foramen Ovale.

The Angle of the Os Pubis anteriorly makes that Connection, called the Symphysis of the Ossa Pubis. This Portion is flat and not very thick; and, in some Subjects, toward the superior Part of the anterior Side, near the angular Curvature, it has an Eminence which increases the Size and Extent of the Spine already mentioned. The two Ossa Pubis, connected by this Portion, form anteriorly an unequal Convexity; but posteriorly a pretty even Cavity.

The Branch of the Os Pubis is a flat thin Apophysis, which, descending, unites with the Branch of the Ischium by a cartilaginous Symphysis,

physis, of which only some Vestiges remain in Adults. It completes the Formation of the Foramen Ovale. The Branches of the two Ossa Pubis form, anteriorly, a pointed Arch; which, in the natural State, is much rounder.

Besides what has been said of the Acetabulum in general, there are other Particulars to be observed, which could not well be mentioned till after the Description of the three Portions, of which it is composed. These are the Margin called Supercilium, the cartilaginous Cavity, the Impression at the inferior Part of it, and the Scissure in the Margin.

The Margin, or Supercilium, is very prominent superiorly; on the Sides this Prominence decreases as it descends, and between the anterior and inferior Part, is quite lost. In the natural State it is increased by an additional elastic Circle, which shall be described.

The Cavity is proportionable to the Prominence of the Margin, and consequently deeper on the superior and posterior, than on the inferior and anterior Part. It is covered with a very smooth Cartilage except from the Middle to the Scissure.

This Portion of the Cavity, which is without Cartilage, is what Winslow calls the unequal Impression, which is broader toward the inferior Cavity, than toward the Margin, and serves to contain a Ligament and a Fasciculus of Glands.

The Scissure is exactly between the anterior and inferior Portion of the Margin of the Cavity, near the Foramen Ovale, which in a Manner, unites with it. The Situation of this Scissure is oblique, with respect to the Direction of the whole Body in an erect Posture.

The Substance of all the three Portions is mostly spongy, except in the Middle of the Os Ilium,

where the two Tables uniting, renders the Bone tranſparent; and the ſame is to be ſaid of the Acetabulum.

The Oſſa Innominata are connected to the Os Sacrum, and to each other by a cartilaginous Symphyſis. They are articulated with the Os Femoris by Enarthroſis, as we ſhall ſee in deſcribing that Bone.

The Oſſa Innominata, together with the Os Sacrum, form the Pelvis, which is Part of the Cavity of the Abdomen, and ſupports ſeveral Viſcera, eſpecially thoſe which are the common Receptacles of the Urine and groſs Excrements, and thoſe by which the two Sexes are diſtinguiſhed.

The Pelvis is larger in Women than in Men; the Oſſa Ilium and Iſchium are wider. The Curvature, formed by the Branches of the Oſſa Pubis, is likewiſe greater in Females. In an Infant the great thick Part of this Bone is in a cartilaginous State; and the ſpinous Proceſs, great Tuberoſity, and recurved Branch are all in the ſame Condition.

Moreover theſe Bones, together with the Os Sacrum, ſupport the whole Trunk, and all the Parts belonging to it, and alſo the inferior Extremities. In a Word, they are the Baſis of the whole Body, and the general Center of all its Motions, when ſtanding, ſitting, or lying.

LECTURE VIII.

The CARTILAGES and LIGAMENTS of the TRUNK.

THE CARTILAGES of the Vertebræ in general are of two Kinds; one proper to each, and the other common to the two that lie next each other. The firſt I term Cartilages of Articulation, the others Cartilages of Symphyſis.

The proper articular Cartilages of each Vertebra of the whole Spine, are thoſe Four which cover the Surfaces of the four ſmall articular Apophyſes. Their Circumference is the ſame with that of the articulated Surfaces of the Apophyſes, except in thoſe Places where there are ſmall ſuperficial Sciſſures.

In the firſt cervical and lumbal Vertebræ, thoſe Cartilages are thicker than in the reſt.

The two inferior articular Cartilages of the firſt Vertebra, and the two ſuperior of the ſecond, ſeem, in freſh Bones, to be ſomewhat diſproportionate, though not ſo much as in dry Bones; and in ſome Subjects, we find moveable or inter-articular Cartilages, between the Apophyſes of theſe two Vertebræ.

The firſt cervical Vertebra has a ſmall cartilaginous Incruſtation in the Middle of the concave Side of its anterior Curvature, anſwering to another on the anterior Side of the Odontoïd Apophyſis of the ſecond; ſo that theſe two

Vertebræ, have five articular Cartilages each, besides the inter-articular ones already mentioned.

The dorsal Vertebræ, besides the four Cartilages of their small Apophyses, have others which do not belong to their Articulations with one another, viz. those which cover the lateral Fossulæ in the Bodies of these Vertebræ and the Fossulæ of their transverse Apophyses, by both which they are articulated with the Ribs.

The Cartilages of Symphysis lie between the Bodies of the Vertebræ, one of them being contained between, and closely joined to the inferior Surface of the Body of one Vertebra, and to the superior Surface of that next under the former; the Breadth and Circumference of them answering exactly to that of the Surfaces, to which they are connected; but their Height or Thickness is different in each Class of the Vertebræ. In the Lumbal, they are a quarter or third Part of an Inch in Thickness, according to the Stature of the Subject.

The Cartilages in the cervical Vertebræ are not so thick, and the thinnest of all are the Dorsals.

These Cartilages are not of an equal Thickness in all their Parts; the Cervical and Lumbal appear to be thickest anteriorly, and the Dorsals rather thickest posteriorly; but these Differences are most remarkable in the Vertebræ, that lie near the Middle of each Class.

The internal Structure of these Cartilages is different from that of all the other of the Body; and indeed they resemble the rest in nothing but in Whiteness and Elasticity.

When we view their Circumferences only, they seem to be one uniform Mass as the others generally are; but when they are joined, we see that they are composed of a great Number of cartilaginous concentrical Circles contained within each other;

other, and a small Space left between them. They are closest and thinnest near the Centre, and about the Middle seem to degenerate into another softer kind of Substance.

These Circles do not form an intire Circumference, being turned interiorly and posteriorly, answerable to the posterior Scissure in the Body of each Vertebra.

They lie horizontally, one Margin being fixed to the inferior Side of one Vertebra, and the other to the superior of the next below the former. The Interstices between the Circles, are filled with a mucilaginous Substance, less fluid than that of the Joints; and their Breadth and Heighth is proportionable to the Distance of the Vertebræ between which they lie.

Each cartilaginous Lamina, taken separately, is very pliable according to its Length, but taken all together, they are not so easily bent, partly because of their circular Figure, and partly because of their Proximity and Multiplicity.

They yield, however, in the Inflexions of the Spine; and their external Surface (which in the ordinary Situation of the Spine is even with the Surface of the Vertebræ) becomes prominent, or projects on that Side toward which the Inflexion is made, the Cartilages being then compressed by the Vertebræ.

They likewise yield on all Sides, without any Inflexion of the Spine to the Weight of the Head and superior Extremities; but this is done by very small and imperceptible Degrees, and most of all, when the superior Parts of the Body are loaded with any exterior Weight.

They restore themselves afterwards merely by being freed from Compression; so that a Man is really taller after lying some time, than after he has walked or carried a Burden for a great while;

the

the most natural and simple Reason that can be given for the different Heights of the same Person, at different times, first observed in England, and afterwards confirmed by M. MORAND*, being the different State of the inter-vertebral Cartilages.

The inter-vertebral Cartilages of the Neck lying, for the most part, between the convex Side of one Vertebra, and the concave of another, are of a greater Extent in Proportion to the Size of these Vertebræ, than the Dorsal and Lumbal.

Without this Convexity and Concavity in these Vertebræ, (which are the least of all) the Cartilages could not have been large enough to be able to resist Strains and great Motions.

The Os Sacrum has no Cartilage, except that between the superior Side of the first false Vertebra, and the last Lumbal, and those by which it is connected with the Ossa Innominata.

The inter-vertebral Cartilages of this Bone in an Adult, are too much obliterated to need a Description.

The Cartilages which connect the different Portions of the Os Coccygis are preserved in some Subjects, to a very great Age; in others they soon intirely ossify.

LIGAMENTS OF THE SPINE.

The Vertebræ are strongly connected to each other by three Kinds of Ligaments; each Vertebra is connected to that above and below it, by a great Number of others, very short and strong, which cross each other obliquely, and are fixed round the Margins of the Body of each Vertebra.

* A Member of the Royal Academy of Sciences of Paris.

These

Theſe crucial Ligaments cover the Circumference of the inter-vertebral Cartilages, and adhere cloſely to them.

They ſeem to be looſer in the cervical and lumbal Vertebræ, than in the Dorſals, and by that means yield to the Cartilages in the different Inflexions of the Spine already mentioned.

The Bodies of all the Vertebræ, from the ſecond Cervical to the Os Sacrum, are covered by ligamentary Semi-vaginæ on the Convexity, in which theſe Vaginæ are fixed, ſurrounding all the crucial Ligaments, and compoſed of ligamentary Faſciculi and Filaments, partly oblique, but moſtly longitudinal.

All the Vertebræ are likewiſe ſtrongly connected by a ligamentary Tube, which lines the interior Surface of the medullary Canal from the occipital Foramen, to the Os Sacrum, at the ſuperior Part, being equal to that of the occipital Foramen, and terminating in a ſmall Pivot at the Os Sacrum.

This Ligament is compoſed of ſeveral Strata of longitudinal and oblique Fibres, interwoven together, and adhering cloſely to the Inſide of the great Foramen, in each Vertebra, by a great Number of Filaments detached from it to the porous Subſtance of the Vertebræ.

The firſt Vertebra is not only fixed to the Os Occipitis, by a Portion of this ligamentary Tube, but alſo by a diſtinct and very ſtrong ligamentary Integument, which ſurrounds and adheres very compactly to the tubical Part.

This Covering is fixed above, round the great occipital Foramen, where it begins to adhere to the Tube, and below, quite round the Circumference of the firſt Vertebra.

The ſecond Vertebra has two Ligaments peculiar to it, one which connects the Apophyſis Dentiformis

tiformis to the Os Occipitis; and another tranſverſe, which confines this Apophyſis within the anterior Portion of the Cavity of the firſt Vertebra. The firſt may be termed the Occipital, and the ſecond the tranſverſal Ligament of the Odontoïd Apophyſis.

The occipital Ligament is very ſtrong and thick, and adheres in a very ſingular Manner to the three Planes of the Apex of the Apophyſis, and is afterwards divided into two or three Portions which are fixed in the like manner, in the anterior Margin of the great occipital Foramen, and in the Inequalities of the Apophſis Baſilaris near that Aperture.

The tranſverſal Ligament may be properly ſaid to belong to the firſt Vertebra, both Ends of it being inſerted in the lateral Impreſſions of their Surface of that Vertebra mentioned in the Deſcription of the Skeleton. But it is ranked among the Ligaments of the ſecond Vertebra, becauſe of its Uſe, and the Inſertion of its middle Portion.

This thick Ligament is ſtretched from one Side of the interior Surface of the firſt Vertebra, to the ſecond.

About the Middle of the anterior Side, its Texture is very compact, and it is fixed by this Portion poſteriorly to the Apophyſis Dentiformis, and ſometimes it ſeems to have additional Faſciculi; which adhere by one End to both Extremities, and by the other, to each Side of the Apophyſis.

Along the whole oſſeous Canal of the Spine, between the Baſes of each ſpinal Apophyſis, lies a flat and very elaſtic Ligament of a yellowiſh Colour, which fills up the poſterior great Sciſſures of the Vertebræ, adhering to their Margins; and likewiſe to the adjacent Portions of the great ligamentary Tube.

Between

Between the Extremities or Apices of the ſpinal Apophyſis, we find ſmall ligamentary Ropes, which go from one Spine to another; and which are really double, though they ſeem to be ſingle in the Dorſal and Lumbal. In the cervical Vertebræ, they are fixed ſeparately to the forked Extremities of the Spines.

Between all the ſpinal Apophyſes, from their Apices, to the Middle of the Baſes, lies a ligamentary Membrane paſſing between each two Apophyſis, and thereby diſtinguiſhing the right Side of the Vertebræ from the left. There is a Ligament of the ſame kind between the tranſverſal Apophyſis.

Theſe are inter-muſcular Ligaments, or ligamentary Septa, which divide the Muſcles of one Side from thoſe of the other, as was already obſerved in ſpeaking of the Ligaments in general, and will appear more particularly in the Deſcription of the Muſcles. The firſt Kind are termed Inter-ſpinales, the other Inter-tranſverſales.

The articular Ligaments of the Spina Dorſi, are thoſe which tie the glenoïd Cavities of the firſt Vertebra, to the Condyles of the Os Occipitis; thoſe that join the cartilaginous Surface of the Apophyſis Dentiformis, to the anterior Cavity of the firſt Vertebra; and thoſe by which all the oblique or articular Apophyſes are connected.

Theſe are all ſmall, ſhort, ſtrong ligamentary Faſciculi, fixed by both Extremities, round the cartilaginous Surfaces of the Apophyſes, ſurrounding very cloſely all the capſular Ligaments of theſe Articulations.

The vertebral Ligaments of the Ribs, or thoſe which connect the Ribs to the Bodies and tranſverſe Apophyſes of the dorſal Vertebræ, are of the ſame kind; being inſerted round the cartilagi-

nous

nous Fossulæ, in the Body and Apophysis of each Vertebra.

Besides all these Ligaments of the Spina Dorsi, there is one which goes in the Form of a Membrane, from the Os Occipitis, all the way to the last two cervical Vertebræ.

It is broad at the superior Part, and from thence diminishes gradually. By its superior broad Extremity, it is fixed along the occipital Spine, and by one Margin, in the posterior Tubercle of the first Vertebra, between the two spinal Furcæ of the following Vertebræ, and in the Apices of the spinal Apophyses of the inferior Vertebra; but the other Margin is loose. This is a true inter-muscular Ligament; and WINSLOW names it, Ligamentum Cervicale Posterius.

There are two lateral Ligaments of the same kind fixed to the transversal Apophyses of the cervical Vertebræ, which shall be described together with the Muscles.

CARTILAGES OF THE STERNUM AND RIBS.

The STERNUM of an Adult has commonly sixteen Cartilages, fourteen of which are articular, the other two Symphyses. Of the articular Cartilages, two belong to the Articulations of the Clavicula, and twelve to those of the true Ribs, from the second to the seventh inclusively. The two Symphyses are those between the Sternum, and the first Rib on each Side.

There is likewise another Symphysis, by which the superior Portion of the Sternum is connected to the inferior, the Cartilage of which is obliterated in advanced Age.

The Apophysis Ensiformis is often osseous toward the Sternum, and more or less cartilaginous at the other End.

In

In very aged Perfons it has been found intirely offified; and fometimes wholly cartilaginous, even in Adults.

Ligaments of the Sternum and Ribs.

The Sternum has feveral Ligaments, by which it is connected with the Clavicles and Ribs. It is articulated to the Clavicles, by ftrong fhort Ligaments, fixed by one Extremity round the Margins of its two fuperior Sciffures; by the other, in the Extremity of each Clavicle, and by the Middle, to the inter-articular Cartilages already explained, furrounding the particular Ligaments which go between the Margins of thefe Cartilages and the Sternum; aud the capfular Ligaments between them and the Clavicles.

All the Ribs are connected to the Bodies of the Vertebræ, by ftrong, fhort, ligamentary Fafciculi, fixed by one End round the Foffulæ in the Vertebræ, and by the other round the Head of each Rib.

The Ribs are likewife tied to each other, by thin Ligaments which go obliquely from the Cartilages of each Rib, to that of the next.

All the Ribs have cartilaginous Portions, which differ from each other in Length, Breadth, Incurvation, Adhefions, and in their Extremities; all which were explained in the Defcription of the Skeleton.

The ten fuperior Ribs on each Side are connected to the tranfverfe Apophyfes of the dorfal Vertebræ, by ftrong, fhort, articular Ligaments fixed to the Tuberofities of the Ribs, and round the Foffulæ of the Apophyfis, much in the fame manner with thofe which go between the Heads of the Ribs and Bodies of the Vertebræ. Both thefe

theſe Articulations are provided with capſular Ligaments.

The eleventh Rib, on each Side, having no Articulation with the tranſverſe Apophyſes, is connected to them by auxiliary, ſtrong, ſhort Ligaments fixed in its Cervical.

The laſt Rib is only connected by its Head to the Body of the twelfth dorſal Vertebra; but it is connected in a particular manner to the tranſverſe Apophyſis of the firſt lumbal Vertebra, by a broad Ligament fixed in the whole ſuperior Margin of the Apophyſis, and in the inferior Margin of the Rib, through about Two-thirds of its Length.

The firſt true Rib has no ligamentary Connection with the Sternum, the cartilaginous Symphyſis being ſufficient. The reſt are cloſely joined to that Bone, by ſmall ligamentary Portions fixed by one Termination round the Extremity of the Cartilage, and by the other, round the Sciſſure in the Sternum. On the ſuperior and inferior Sides of each Articulation, theſe Ligaments are very ſhort, but anteriorly they are expanded over the Sternum in a radiated manner.

The Cartilage of the firſt falſe Rib, is joined to that of the laſt true Rib, by ſeveral ſhort Filaments, which go from the inferior Margin of the one, to the ſuperior Margin of the other, near its ſmall Extremity.

The other falſe Ribs are connected together much in the ſame manner, with this Difference only, that the Filaments by which the fourth Rib is connected to the third, are longer than thoſe above them; and thoſe between the fifth Rib and the fourth, much longer than any of the reſt: and for this Reaſon, thoſe two Ribs are leſs ſteady than the others.

The

THE PERIOSTEUM, MARROW, AND MUCILAGINOUS GLANDS OF THE VERTEBRÆ, STERNUM, AND RIBS.

The ligamentary Expanſions of the Vertebræ are in lieu of a Perioſteum, both externally and internally. The Sternum and the oſſeous Portions of the Ribs have a Perioſteum like the other Bones. The cartilaginous Portions of the Ribs are covered by a Membrane of the ſame Kind, termed Perichondrium. As the internal Structure of the Bones is cellulous or ſpongy, they contain only ſmall ſeparate Portions of Marrow, or a red medullary Juice that is in the Vertebræ.

The mucilaginous Glands of all theſe Articulations are very ſmall, but accompanied by many fatty Moleculæ lying round each Joint. The interior Surface of the ligamentary Tube, which lines the oſſeous Canal of the Spine, is lubricated by an oleaginous Subſtance, which ſhall be taken notice of in the Deſcription of the Brain.

THE CARTILAGES OF THE OSSA INNOMINATA.

They are not ſo numerous as one might imagine, on examining the Skeleton only. We are apt to think we ſee the dried Remains of Cartilages on the Criſta of the Os Ilium, on the Tuberoſity of the Os Iſchium, and on the Sinuoſity and Sciſſures which give Paſſage to the Tendons. But none of theſe Incruſtations are true Cartilages, being, for the moſt part, tendinous, aponeurotic, or ligamentary, which, being dried, look more like Cartilages, than the true Cartilages themſelves.

The Cruſt which covers the Criſta of the Os Ilium is chiefly tendinous, and a ſmall Part of it

 aponeurotic

aponeurotic in Adults; but in Children and Persons advanced in Years, it appears cartilaginous. In Children, the Parts which are not completely ossified, are easily taken for true Cartilages; and in old Age, the Tendons are often hardened to so great a Degree, as to have the very same Appearance. The Substance which covers the Tuberosity of the Ischium, is almost tendinous, and that which lines the Sinuosities and Scissures of the Tendons is chiefly ligamentary.

The true Cartilages of the Ossa Innominata, in adult Subjects, are five; three common, and two proper.

The first and principal common Cartilage, is that which makes the Symphysis of the Ossa Pubis. It reaches from the internal between the Spines of these two Bones, all the way to the Angle formed by the two Rami, where it begins to separate. It is something thicker or broader superiorly, for a considerable Space, than inferiorly; but this Part is much the broadest. It fills the Angle already mentioned, and forms a kind of Curvature, which is more considerable in Women than in Men.

The two other common Cartilages join the Ossa Ilium, to the Os Sacrum, but are thinner than that of the Ossa Pubis.

The proper Cartilages are those that line the cotyloïd Cavities. Concerning these, we have already observed in the Description of the Skeleton, that in the Margin of each, there is a Scissure or Opening between the anterior and inferior Parts; and that in the Cavity itself, there is a broad unequal shallow Depression, reaching from the Scissure, beyond the Middle of the Cavity. All the rest of the Surface of the Acetabulum is covered with a very white, shining, smooth Cartilage; which

which terminates precisely at the Margin of the Cavity.

The Circumference of the Acetabulum has besides a Margin of a particular kind; the Substance of which is neither wholly cartilaginous nor ligamentary, and will be described among the Ligaments.

Ligaments of the Ossa Innominata.

These Ligaments are of two Kinds, Common and Proper. The common are those which go between these and the adjacent Bones, of which there is a considerable Number, viz.

One superior Ligament inserted by an Extremity in the internal Labium, posteriorly to the Crista of the Os Ilium, about an Inch above the Angle of that Crista. It is about an Inch in Breadth, and is fixed by its other Extremity in the whole inferior Margin of the transverse Apophysis of the last lumbal Vertebra.

One inferior and anterior, fixed by one End interiorly to the Angle of the Crista of the Os Ilium, and by the other superiorly and anteriorly to the first false transverse Apophysis of the Os Sacrum. In this Ligament there are transverse Openings which make it appear more or less complex.

Several inferior and posterior are fixed by one End along the internal Labium of the Tuberosity of the Crista of the Os Ilium, and by the other in the first three false Apophyses, over the Marks of the false oblique Apophyses of the Os Sacrum.

To these must be added the Ligaments by which the Os Femoris is connected to the Os Innominatum, which shall be discribed among the other Ligaments of the Thigh.

The principal proper Ligaments are four in Number; two called Sacro-Sciatic, one broad and external, the other ſmall and internal, one obturatory, and one inguinal.

The broad ſacro-ſciatic, or internal ſciatic Ligament is ſlightly fixed interiorly to the Tuberoſity of the Criſta of the Os Ilium, covers exteriorly the two poſterior Spines of that Bone, and continues to be inſerted along the anterior and exterior Margins of the falſe tranſverſe Apophyſes of the Os Sacrum. Thence this Ligament diminiſhing in Breadth, deſcends obliquely towards the Tuberoſity of the Iſchium, and is immediately inſerted below the Sinus, which lies between that Tuberoſity and the ſciatic Spine. This Inſertion is afterwards continued over the whole internal Labium of the inferior Portion of the Ramus of the contiguous Os Pubis.

Through all the lateral Courſe of its Inſertion, that is, after its Arrival at the Tuberoſity of the Iſchium, it produces a Kind of ligamentary Falx, one Edge of which is fixed in the Bones, the other lies looſe; and by this Situation of the Falx, it forms, together with the Bones, a kind of deep Canal or Sinus.

The ſmall ſacro-ſciatic or internal ſciatic Ligament adheres very cloſe interiorly to the poſterior Portion of the former. It is fixed interiorly to the Margin of the inferior Part of the fourth falſe tranſverſe Apophyſis of the Os Sacrum, and thence all the way ſuperiorly to the Os Coccygis.

From this Inſertion, it aſcends a little obliquely to the Spine of the Iſchium, to which it is fixed in the acute Apex and ſuperior Part, during this Courſe, tranſverſes the broad Ligament, being cloſely united to the Inſide thereof, loſing but very little of its Breadth.

By

By these two Ligaments, two distinct Apertures are formed, a large one with the superior sciatic Sinus, and a small one, with the inferior sciatic Sciffure.

The obturatory Ligament fills up all the great Foramen Ovale, except the oblique Sciffure at its superior Part. It is fixed exactly to the Margin of the Circumference of that Aperture, from the anterior Part of the oblique Sciffure, all the way to the Symphysis between the Os Pubis and the Os Ischium; thence posteriorly to the inferior Sciffure. It is fixed to the internal Labium of the Margin of the Circumference, forming a kind of small Canal with the external Labium; and afterwards to the common Margin of the Foramen Ovale, and cotyloïd Sciffure or Opening.

By this Disposition, an Aperture is left between this Ligament, and the superior oblique Sciffure; and immediately below this common Aperture, there are two small Perforations in the Ligament itself.

On the inside of the superior and interior Part of the Os Pubis, there is a transverse Ligament fixed superiorly to it from the oblique Sciffure of the Foramen Ovale, all the way to the inferior Part of the Symphysis, at a small Distance from the Circumference of the last mentioned Aperture.

This transverse Ligament is about half an Inch in Breadth in an Adult, and posteriorly below the superior oblique Sciffure of the Foramen Ovale, it connects the obturatory Ligament, by means of a particular Plica; and by parting from it afterwards, a kind of deep narrow Sinus is formed between them; the transverse Ligament being there supported by ligamentary Fræna of different Sizes.

The inguinal Ligament, called from the Difcoverer, Ligamentum Fallopii, is only an aponeurotic or ligamentary Membrane, fixed by one Extremity to the anterior and fuperior Spine of the Os Ilium, and by the other to the Spine of the Os Pubis. The middle Portion of it is very narrow, but it expands confiderably toward both Extremities. It is clofely connected to the abdominal Mufcles, and to the aponeurotie Fafcia of the Thigh. It feems to be often wanting, as fhall be obferved in the Defcription of the Mufcles.

Befides thefe Ligaments peculiar to each Os Innominatum, there is another fmall, flat, and very ftrong Ligament, which runs tranfverfly between the two Angles of the cotyloïd Sciffure, and may be reckoned among the Ligaments. It is a fort of additional Piece, ftrongly united to the Margin of that Cavity, but eafily yields both ways to any Preffure. It may be ftretched out by pulling, and recovers and contracts again, when that Force is removed. It is of a very fingular Texture, being compofed of elaftic Fibres, interwoven together through its whole Circumference, and which, in feveral Places are by degrees inclined toward the offeous Margin of the Cavity.

It makes an intire Circle, and where it paffes over the Sciffure, the tranfverfe Ligament, before mentioned, ferves to fupport it, as the offeous Margin of the Cavity does through all the reft of its Circumference.

Though I have referred the Defcription of the two Ligaments, by which the Os Femoris is connected to the Os Innominatum, to another Place, their Infertions in the laft named Bone muft neverthelefs be mentioned here. One of thefe Ligaments furrounds the whole Articulation, the other is contained therein. The firft is called the Orbicular

cular Ligament, the other, very improperly, the round Ligament.

The orbicular Ligament is very ſtrong and unequally thick. It ſurrounds the whole convex Circumference of the Supercilium of the cotyloïd Cavity is to which it is ſtrongly fixed, for the Breadth of near a Quarter of an Inch, from the acute Margin externally, and thence ſeems to ſend off a ligamentary Aponeuroſis which ſhall be explained in the Myography.

Its Inſertion at the ſharp Margin of the cotyloïd Cavity is connected to that of the elaſtic Border; the reſt of the Ligament is diſtinct from the Border, and only touches it quite round, and where it paſſes over the Sciſſure, is fixed in the tranſverſe Ligament.

The Ligament which lies in the Joint is not round, as its Name imports. It is a flat Cord, broad at one Extremity, and narrow at the other; and therefore, in ſome meaſure, of a triangular Shape. By its narrow Margin, it is inſerted at the two Angles in the Sciſſure of the cotyloïd Cavity, and by the other in the Os Femoris, as ſhall be deſcribed. This broad Extremity may be reckoned the Baſis of the Ligament; and thence ariſe ſome diſtinct ligamentary Filaments, which are inſerted at different Diſtances, in the Circumference of the rough Impreſſion of the cotyloïd Cavity.

Membranes, mucilaginous Glands, and Marrow of the Ossa Innominata.

There is nothing in the Perioſteum of theſe Bones different from what has been ſaid above, except what relates to the Inſertion of ſeveral Muſcles; but that cannot be explained till theſe Muſcles are deſcribed.

The rough unequal Depreſſion, at the Bottom of the cotyloïd Cavity, is filled by a broad, flat, mucilaginous Gland, bordered with an oſſeous Subſtance, and covered by a fine Membrane, through which a mucilaginous Liquor paſſes, to moiſten the Joint and facilitate its Motions.

This Membrane riſes above the Gland, and gives a ſort of Covering to the Ligament contained in the Articulation. The ſanguinous Veſſels of this Gland paſs between the Bottom of the cotyloïd Sinus, and the tranſverſe Ligament thereof.

As theſe Bones have no internal Cavity, and their Subſtance being cellulous or cavernous, they contain no medullary Maſs.

The Cellulæ of their cavernous Subſtance contain a medullary Juice, which diſtils inceſſantly through the Membrane with which they are all lined.

The ſanguiferous Veſſels paſs chiefly through the ſmall Apertures, in the convex and concave Surfaces of theſe Bones; and ramifying upon the oſſeous Cells, terminate in a great Number of minute Tubuli, which make the medullary Juice appear reddiſh.

Observation.

Though the Curvature of the Spine, which I am going to deſcribe, is different from a Gibboſity, yet ſtill it has ſome Affinity to it. A labouring Woman, who uſed to carry heavy Baſkets of Sand on her Back, there was no apparent Deformity; the winding Flexures of the Vertebræ ſo correſponding with each other, as to hide it; till, in diſſecting her, when I came to examine the abdominal Viſcera, I found the Aorta diſplaced very much to the left Side, and upon laying the Bones of the Thorax quite bare, found the two ſuperior dorſal Vertebræ retained their natural Situation. The third inclined to one Side in ſuch a Manner, that its

its Middle was turned towards the left, but the whole taken together, pointed towards the left, in its ſuperior Part, and in its inferior towards the right. In the fourth and fifth, theſe Circumſtances were more obſervable; but in the ſixth the Diſtortion was much more obvious, ſo that the Body of it was wholly turned to the right Side, and nothing appeared on the anterior Part, but the lateral Portion, which is neareſt to the Articulation with the Ribs. The ſeventh was diſtorted in the like Manner, except that the inferior Extremity inclined it again to the left. Below this, the whole Spine was turned towards the left, and at the ſame time the right Side of the Bodies of the Vertebræ projected anteriorly.

Laſtly, In the anterior Part of the eleventh and twelfth dorſal Vertebræ, a preternatural Tuberoſity appeared, formed by an Anchyloſis of the two contiguous Vertebræ, and copiouſly pouring out from the Sides of their Bodies an oſſifying Fluid, which concreting into a very hard and ſmooth Tubercle, united them in that Part; the laſt and remaining of the inter-vertebral Ligament ſtill retaining its cartilaginous Tenacity. On the left Side of the Bodies of the firſt and ſecond lumbal Vertebræ, it had a remarkable Cavity. Vid. Longhans in Haller's Pathological Obſervations.

I have a Skeleton of a Lad whom I diſſected about two Years ago, in which the four inferior dorſal Vertebræ were ſo curvated anteriorly, and by Anchyloſis, that the fourth inferior dorſal Vertebra almoſt reached the ſuperior Part of the firſt Lumbal. All the Bodies of the twelve Dorſals were carious anteriorly. The Vena Cava was lacerated at the Curvature of the Vertebræ, which was the Cauſe of his ſudden Death. The Subject was born crooked, and his Bones are very white and light, which inclines me to think that the Diſeaſe was in the oſſifying Fluid.

LEC-

LECTURE IX.

The Superior Extremities.

EACH ſuperior Extremity is commonly divided by Anatomiſts, into Scapula, Clavicula, which compoſe the Shoulder, Arm, Fore-arm, and Hand. The Arm conſiſts of one ſingle Bone called Os Humeri, and the Fore-arm conſiſts of two, the one called Cubitus or Ulna, and the other Radius.

The Hand is compoſed of the Carpus or Wriſt, the Metacarpus, and the Fingers.

As to the Scapula and Clavicula, I thought proper to range them among the Bones of the Trunk already deſcribed. For if theſe Bones belong to the ſuperior Extremities, in like manner muſt the Oſſa Innominata be deſcribed in the Diviſion of the inferior Extremities; which has not been done by any Author I know of, under that Denomination. For as the Scapula receives nothing more than the Head of the Os Humeri, ſo the Oſſa Innominata receive only the Heads of the Oſſa Femorum.

Of the Os Humeri or Brachii.

The Humerus, or Bone of the Arm, is both longer and thicker than any other Bone of the ſuperior

perior Extremity; it is ſituated under the Acromium laterally to the Thorax, from which, however, it may be removed to a conſiderable Diſtance in all Directions. Its Figure is irregularly cylindrical, thick at one Extremity, and broad at the other.

It is divided into the Body and two Extremities; or into a ſuperior, middle, and inferior Part.

The ſuperior Part is generally called the Caput of the Os Humeri, and that Part immediately below, the Cervix.

In the Caput we conſider a Semi-globus obliquely inclined, cruſted over with a ſmooth Cartilage: Two Tuberoſities, one large, terminating ſuperiorly in a Point, oppoſite to the Semi-globus: A Canal between the two Tuberoſities: Four muſcular Impreſſions, three of which are on the large Tuberoſity, viz. one in the Apex, one on the Side oppoſite to the Sinus, the third lower down on the ſame Side, oppoſite to the ſmall Tuberoſity, upon which the fourth is found. Of theſe four Impreſſions, that on the ſmall Tuberoſity, and the ſecond of the other three, are the largeſt. All theſe Parts of the Caput of the Humerus are one Epiphyſis in Children, of which very viſible Marks remain ſometimes in advanced Age.

The Canal, or Sinus, between the two Tuberoſities, is continued inferiorly in an oblique Direction through one Quarter of the Length of the Bone, and there becoming rough, forms a muſcular Impreſſion not always equally ſenſible. The Margin of this Sinus, are two Ridges, or prominent Lines, continued down, as it were, from the Tuberoſities. That from the great Tuberoſity, being the moſt conſiderable, is continued down to the middle of the Bone, where it is loſt in a long, broad, raiſed, muſcular Impreſſion, more or leſs rough. The other, which comes from the

ſmall

ſmall Tuberoſity, is leſs prominent and ſhorter. At the Side of this Ridge, toward the inferior Part, are two other narrow, longitudinal, and ſuperficial muſcular Marks one above the other; the inferior Extremity of the firſt reaching down to the anterior of the ſuperior Extremity of the ſecond.

The middle Part, or Body of the Humerus, comes nearer to a cylindrical Figure than the Extremities. It is a little raiſed at the rough Eminence, or Impreſſion, already mentioned. On each Side of this Eminence, is another muſcular Impreſſion, which, uniting immediately below it, appears to be incloſed between them, as between the two Prongs of a Fork. On that Side which anſwers to the middle of the Semi-globus, we ſee likewiſe a longitudinal muſcular Mark, and about the Middle of that Side, which is even with the great Tuberoſity, there is an oblique concave Turning, of a conſiderable Length and Breadth, which, deſcending by the Side of the forked Impreſſion, makes this Part of the Bone appear contorted.

This inferior Extremity of the Humerus is triangular from its very Beginning, and thence grows flat, being bent a little near the Extremity, towards that Side which anſwers to the ſmall Tuberoſity in the ſuperior Extremity. It is divided into three Sides, two anterior, and one poſterior, which is the broadeſt; and into three Angles, one anterior, and two lateral. At the End of this broad Extremity, are two Tuberoſities, one ſhort and prominent, anſwering directly to the Middle of the Semi-globus; the other oblong, rough, and reſembling a Criſta, which anſwers to the Apex of the great Tuberoſity of the Head. The ſhort Tuberoſity is called the Internal Condyle, the other the External.

Between

Between these two Condyles, on the lower Part of the cancave Side of this Extremity, are two articular Extremities, one double like a Pulley next the short Condyle, the other rounded like a small Head next the long Condyle.

The Trochlea has a great and small Margin with a Depression between them; the small Margin is lost in the round Eminence or Head; the great one is gradually widened, and ends in a sharp Circumference. This Trochlea is situated obliquely; for on the concave Side, it approaches toward the short Condyle, and on the other, it is turned from it. Three Fossulæ are likewise observable in this inferior Part of the Bone; two anterior, one immediately above the Trochlea, the other above the small Head; and one posterior, which is very large, and situated likewise immediately above the Pulley. In Children, the Pulley, the small Head, and the short Condyle, are Epiphyses.

The external Substance of this Bone is complete, especially in the Middle, within which there is a large tubular Cavity, containing a reticular Texture of osseous Filaments. The external Sides of the Extremities are less solid, and their internal Substance is cellulous.

The particular Situation of this Bone deserves to be well considered; because we are often misled in forming an Idea of it, by viewing the Bone itself, separated from the Trunk by the Figures which have been given of it, and by the undue Application of the Terms, external, internal, anterior, and posterior, to the different Parts thereof; which Mistakes may be of very bad Consequence in many chirurgical Cases.

When we examine the Os Humeri as lying along either Side of the Trunk, in its natural Situation, the Head will be found so disposed, as that the Semi-globus is turned interiorly and posteriorly, an-

swering

ſwering to the Situation of the glenoïd Cavity of the Scapula; the great Tuberoſity, externally and anteriorly; the Canal between the two Tuberoſities, almoſt directly forward; the long Condyle, ſaid commonly to be external, is turned as much anteriorly as exteriorly; and the ſhort Condyle, the Internal turned as much poſteriorly as interiorly.

This Bone is articulated above with the glenoïd Cavity of the Scapula, by Enarthrodia; and below, with the two Bones of the Fore-arm, in the Manner hereafter deſcribed.

Both the Extremities of this Bone are cartilaginous in a new-born Infant, and the large Head, with the Tubercles, and the Trochlea, with the two Condyles, become Epiphyſes, before they are united to the Body of the Bone.

Of the Ulna, or Cubitus*.

The Ulna, ſo termed from the Uſe of it by the Ancients, is irregularly triangular, diminiſhing in Thickneſs from one End to the other. It may be divided into the Body, or middle Part, and two Extremities, one great, the other ſmall.

In the great Extremity, we obſerve two Eminences; one large, called Olecranum, or Ancon; the other ſmall, called Corone, or the Coronoïd Apophyſis; and two Semilunar, or Sigmoïd Cavities, one great, the other ſmall.

The Olecranum is a large Apophyſis ending in a rough Tuberoſity, and an obtuſe Point. The Tuberoſity makes the Corner of the Elbow; the Point is lodged in the poſterior Cavity of the inferior Extremity of the Os Humeri, when the Fore-arm is extended. Next, under the Tubero-

* Focile majus, canna, vel arundo, major & inferior Brachii.

ſity,

ſity, is a flatiſh, oblong, triangular Surface; external to which, is another of the ſame kind, but longer and a little concave, together with a muſcular Foſſula.

The coronoïd Apophyſis is prominent and a little pointed, reſembling a broad ſhort Beak. It is received into the anterior Cavity above the Trochlea, at the inferior Extremity of the Humerus when the Fore-arm is bent.

The great ſigmoïd Cavity lies directly between theſe two Eminences, reaching from the Apex of one, to the other. It is articular, covered with a ſmooth Cartilage, and divided through its whole Length, by a middle angular Line; being thus ſuited exactly to the Pulley of the Humerus, upon which it moves obliquely, theſe two together making a moſt perfect Ginglymus, as well in reſpect of their Structure, as of their Uſe. The half Cavities, on each Side of the angular Line, are alſo divided tranſverſly by another Line, a little concave, which terminates at the middle of each Margin, of the Cavity by a very ſmall Sciſſure.

The ſmall ſigmoïd Cavity, which may likewiſe be termed tranſverſe or lateral, is a ſort of tranſverſe Sciſſure, in the inferior Portion of one Margin of the great ſigmoïd Cavity, at the Side of the coronoïd Point, directly oppoſite to the muſcular Foſſula, already mentioned. It is covered with a Cartilage, as well as the great one, of which it appears to be a true Continuation, and it belongs to the Articulation of the Radius.

Near this Cavity, directly under the coronoïd Apophyſis, there is a very muſcular Impreſſion ſometimes raiſed like a Tuberoſity.

This ſuperior Extremity is oblique, and its Obliquity anſwers to that of the Trochlea of the Humerus.

The ſmall Extremity is cylindrical, of a leſs Diameter than any other Part of the Bone; it may be reckoned a kind of Cervix, ending in an inverted Head, flat at Top, and of a cylindrical Circumference, both which are covered with the ſame ſmooth Cartilage, and the Circumference is broader on the Side of the coronoïd Apophyſis and ſmall ſigmoïd Cavity, than any where elſe. From the Head, deſcends a ſhort ſtyloïd Apophyſis on the Side of the Tuberoſity of the Olecranum, diſtinguiſhed from the reſt of the Circumference by a ſmall Sciſſure.

The middle Portion, or Body, of the Ulna is divided into three Sides and three Angles. One of the Sides is narrow and rounded, one broad and concave, and the third flat, and marked with an oblique Line on its ſuperior Part. The narrow Side anſwers to the Tuberoſity of the Olecranum, and is covered only by the common Integuments.

The other two Sides are diſtinguiſhed from the former by two blunt Angles; and they unite at a ſharp Angle, which lies oppoſite to the rounded Side, and anſwers to the Point of the coronoïd Apophyſis. The concave Side is even with the ſmall ſigmoïd Cavity, and the flat Side oppoſite to it. Theſe two Sides give Inſertion to many Muſcles, and the ſharp Angle to what is called the Interoſſeous Ligament. At the Apex of this Angle, there is a narrow, oblong, muſcular Impreſſion. The Angle, common to the rounded and flat Sides, terminates inferiorly, in an oblong, uneven, muſcular Eminence.

The Subſtance of the Ulna is much the ſame with that of the Humerus, already deſcribed.

The

The Tuberofity of the Olecranum, and the fmall inferior Head, with its ftyloïd Apophyfis, remain for a long time Epiphyfes, in fome Subjects.

It is connected with the Trochlea of the Os Humeri by an angular Ginglymus; with the two Extremities of the Radius, by a compound lateral Ginglymus; and with the Hand by Ligament, and not by Articulation.

The Situation of this Bone may be confidered two Ways; either when the Fore-arm is extended, and lies along the Side of the Trunk, or when it is bent, and lies on the inferior Part of the Breaft. The firft Situation appears to be moft commodious for determining what Parts of the Bone are to be called Anterior, Pofterior, Superior, Inferior, External, and Internal. But the fecond feems moft natural, as being the moft common in living Bodies, whether fitting or ftanding, and has accordingly been followed by fome of the Antients. I fhall have Occafion to fay fomething more upon this Head, in defcribing the Radius and Bones of the Hand.

Of the Radius*.

The Radius is nearly of the fame Length with the Ulna, bigger at one End than the other, irregularly triangular, a little bent, and fituated along the Side of the Ulna; its Name is taken from the Refemblance it was thought by the Ancients to bear to the Spoke of a Wheel.

We are to confider in this Bone two Extremities and a middle Portion. One Extremity is fmall, and like a kind of Head fet upon a Neck; the other is large, refembling a Pedeftal or Bafis;

* Focile minus, canna minor, arundo minor.

and therefore it might be divided into a Head, Body, and Basis.

The Head, or small Extremity of the Radius is very short or low, the Top of it is concave, and the Circumference cylindrical; and both the glenoïd Cavity and Circumference are covered with the same smooth, shining, cartilaginous Crust; and about one Quarter of the Circumference is broader than the rest.

The Cervix is small, and its Situation a little oblique. It ends by a lateral Tuberosity, which lies directly under the broad Part of the Head, being rough on the Middle, and on one Side, and smooth and superficially cartilaginous on the other.

The Basis, or great Extremity of the Radius, is much broader than it is thick, and has two broad Sides, and one narrow. One of the broad Sides is a little concave, and pretty even; the other is unequally convex, and divided by longitudinal Eminences, or osseous Lines, into three or four longitudinal Canals, much more distinct in fresh Bones, than in the Skeleton.

The narrow Side is concave longitudinally, and between it and the other two, two Angles are formed; by which the three Sides are distinguished; and opposite to it, the other two meet in a third Angle. This narrow Side ends in a semilunar Cavity, bordered with a smooth Cartilage, and lying almost in the same Direction with the Tuberosity. The broad Sides end at their common Angle, by an obtuse Point or Production, which has been called the styloïd Apophysis of the Radius, and is really a Continuation of one of the osseous Lines already mentioned.

The whole Basis ends in an oblong triangular glenoïd Cavity, the Cartilage of which is continued over the concave Margin of the narrow Side. This is an articular Cavity, resembling an Arch, and

ending on one Side at the ſtyloïd Apophyſis, and concave on the other, by the Cavity of the narrow Side. It appears divided into two Portions, by a ſmall tranſverſe Line, and in the natural State, the concave Side is lengthened out by a cartilaginous Production.

The Middle, or the Body of the Radius is a little incurvated, the Concavity lying between the Tuberoſity in the Head, and ſemi-lunar Cavity in the Baſis. It has three Sides; one rounded, which is the convex Side of the Curvature, and two concave: Three Angles, two of which are obtuſes, diſtinguiſhing the two concave Sides from the convex; and the third acute, lying between the two concave Sides oppoſite to the convex Side. In each of the Sides there are ſeveral muſcular impreſſions.

The Subſtance of this Bone is like that of the Ulna; the Head and Baſis are Epiphyſes in Children, and in ſome Subjects remain ſuch for a long time afterward.

The Radius is connected with the Ulna, Os Humeri, and Carpus. It is articulated with the Ulna at its two Extremities, by a double lateral Ginglymus; the cartilaginous Circumference of the Head, turning in the ſmall ſigmoïd Cavity, and the ſemi-lunar Cavity, in the Baſis, turning upon the ſmall Head, at the inferior Extremity of the other Bone; and thus the ſmall Extremity of one Bone is joined to the great Extremity of the other.

It is articulated with the Humerus, by the Application of the Cavity in the Top of its Head to the ſmall Head, at the inferior Extremity of the other Bone.

By this Conformation, it would be capable of moving in all Directions, but as it is tied to the Ulna at both Extremities, its Motions on the

ſmall condyloïd Head, at the inferior Extremity of the Humerus, are confined to two Kinds; that of Rotation, when it turns on the Sides of the Extremities of the Ulna; and that of Flexion and Extenſion, in common with the Ulna; and both theſe Motions may be performed at the ſame time.

The Articulation of the Radius, with the Bones of the Carpus, ſhall be explained in deſcribing theſe Bones.

Of the Bones of the Hand; and first, the Bones of the Carpus.

The Hand is the laſt Part of the ſuperior Extremity, and is divided into the Carpus, Metacarpus, and Fingers, as has been already ſaid in the Enumeration of the Bones of the Skeleton. It may be further divided into the concave and the convex Side. The concave Side is likewiſe called the Inſide, becauſe it is commonly, and (as it were) naturally turned toward the Body, and ſo hid. The convex Side is for the ſame Reaſon, named the External, as being for the moſt part turned exteriorly, and expoſed to View. The firſt is alſo named the Hollow or Palm of the Hand; the other the Back of the Hand.

The Carpus or Wriſt conſiſts of eight ſmall unequal and irregular Bones; and taken all together, they repreſent a ſort of Grotto of an irregular quadrangular Figure, and connected principally with the Baſis of the Radius. Conſidered in this manner, the whole Collection of them, has two Sides, and four Margins. One of the Sides is convex and external, the other concave and internal. The Convexity of the external Side is pretty uniform, but the inner or concave Side has four Eminences, one at each Corner. One of the four

Margins

Margins touches the Fore-arm; and is as it were, the Head of the Carpus; another Margin may be termed the Bafis, and touches the Metacarpus; the third is toward the Apex of the Radius; and the fourth toward the Point of the Ulna. The firft of thefe laft I fhall call the fmall Margin, the other the great.

The Bones of the Carpus, are divided into two Rows; the firft of which lies next the Fore-arm; the fecond next the Metacarpus. Each Row confifts of four Bones, but the fourth of the firft Row lies in a manner out of its Rank; each Bone has feveral cartilaginous Surfaces, for their mutual Articulations; and in fome of them, for their Articulations, with the Radius, and Bones of the Metacarpus and Thumb.

It is to no Purpofe to diftinguifh the three ordinary Dimenfions in any of thefe Bones, except one; but in moft of them, we may confider fix Sides, one external, turned toward the convex Surface of the Carpus; one internal toward the concave Surface; one towards the Fore-arm, which Dr. WINSLOW called the brachial Side; one toward the Fingers, the digital Side; one toward the Point of the Radius, or the radial Side; and one towards the Point of the Ulna, or the cubital Side.

Of thefe Sides fome are offeous, others cartilaginous or articular. Thefe laft we fhall call Sides; the other Surfaces, as being Portions of the common Surface of the Carpus in its natural Situation.

To diftinguifh thefe eight Bones from each other; they are called firft, fecond, third, and fourth Bones of the firft or fecond Row, begining to count from the Radius or Thumb.

LYSERUS has been at great pains to give a particular Name to each of them. He calls the firſt Bone of the firſt Row Os Scaphoïdes, or Naviculare ; the ſecond Os Lunare ; the third Os Cuneiforme ; the fourth Os Piſiforme ; the firſt Bone of the ſecond Row Os Trapezium ; the ſecond Os Trapezoïdes ; the third Os Magnum ; and the fourth Os Unciforme.

The firſt Bone of the firſt Row is termed Scaphoïdes in Greek, and Naviculare in Latin, from its Reſemblance to a ſmall Boat. Next the Radius it has a convex Side, by which it is articulated, with the Baſis of that Bone, and a Tubercle, which is one of the four Eminences, on the concave Side of the Carpus. Toward the Thumb it has two half Sides ; one large, for the Os Trapezium, another ſmall one for the Os Trapezoïdes. It has likewiſe a concave Side for the Os Magnum, and a ſmall ſemilunar Side for the Os Lunare. The interior and anterior Surfaces are rough.

The ſecond Bone of the firſt Row is called Lunare, becauſe one of its Sides is in Form of a Creſcent. The articular Sides in this Bone, are four in Number ; one convex for the Baſis of the Radius ; one ſemi-lunar for the Os Scaphoïdes ; one almoſt triangular, for the Os Cuneiforme ; and one hollow, which, with the concave Side of the Scaphoïdes, forms an oblong Convexity, anſwering to the oblong Concavity in the Baſis of the Radius. The exterior and interior Surfaces are ſmall and rough. This Bone would be better named Os Semi-lunare.

The third Bone of the firſt Row called Cuneiforme, from its Figure, appears rather like a Wedge ſticking between the two Rows. It has a rough Surface, with a ſmall Tubercle upon it, which forms the greateſt Part of the cubital Edge

of

of the Carpus, and four articular Sides; whereof one is convex, which completes the articular Convexity of the Carpus; one orbicular and internal, or on the concave Side of the Carpus, on which the Os Pisiforme is set, and two which make an Angle between them; one for the Os Semi-lunare, and the other for the Os Unciforme.

The fourth Bone of the first Row called Orbiculare, Pisiforme, and Lenticulare, from its Figure and Size, is irregularly round. It has but one cartilaginous Side irregularly orbicular, the Border or Circumference of which represents a sort of narrow Collar. The rest of the Bone, is rough, convex, and irregularly round; making one of the four Eminences on the concave Side of the Carpus. This Bone and the Os Cuneiforme may be supposed to make a third Row, distinct from the other two.

The four Bones of the second Row lie all in a Line; the first being articulated with the Thumb, the rest with the Metacarpus.

The first Bone of the second Row is named Trapezium, or Os Cubiforme, Trapezoïdes, as being supposed to be of an unequal square Figure. Its exterior Surface is rough, and makes a Portion of the convex Side of the Carpus. On its interior Surface, is an oblong Eminence, which makes one of the four Eminences on the same Side it has a Sinus.

There is likewise a small Tubercle, on the exterior Surface.

It has several articular cartilaginous Sides, viz. one brachial, one digital, and two cubital.

The brachial Side, which is concave, is articulated with the Os Scaphoïdes; the digital, with the first Phalanx of the Thumb; one of the cubital Sides, with the Os Trapezoïdes; and the other with the first Metacarpal Bone.

The Side which is articulated with the firſt Phalanx of the Thumb, appears to be made up of two ſuperficial ſigmoïd or ſemilunar Half-ſides, diſtinguiſhed by an Eminence of the ſame Figure, being each more concave toward the Sides, than at the Middle, which makes a Portion of a ſort of ſuperficial Trochlea, with the Margin much worn.

One of the cubital Sides, which is articulated with the Os Trapezoïdes, is large; the other, which connects the firſt metacarpal Bone, is ſmall.

The ſecond Bone of the ſecond Row deſerves the Name of Pyramidale, rather than Trapezoïdes, being a kind of Pyramid, with the Point broke off. Its Baſis makes a Portion of the exterior or convex Side of the Carpus, and its Point a Part of the concave Side.

It has ſeveral articular Sides, viz. one brachial, which is the leaſt of all, and articulated with the Os Scaphoïdes; one digital, of a conſiderable Length, ſciſſured on each Side, and divided into two Halves, by a ſort of middle Line or Angle, which gives it the Appearance of a Trochlea, articulated with the Baſis of the firſt metacarpal Bone; one radial, irregularly triangular, and articulated with the Os Trapezium; and one cubital, a little concave, and articulated with the Os Magnum.

The third Bone of the ſecond Row, called Os Magnum, Maximum, or Capitatum, ſo named, being the largeſt of all the carpal Bones, is of a conſiderable Length, and has a kind of articular round Head, which is received into the cotyloïd Cavity, formed by the two firſt Bones of the firſt Row; and this Articulation is capable of a ſmall degree of Flexion and Extenſion.

The digital Side is a cartilaginous Baſis, unequally and obliquely triangular; the Apex being turned

turned internally. It is articulated with the second metacarpal Bone, and is alſo a little ſciſſured on the radial Margin, for its Articulation with the ſmall Margin of the firſt metacarpal Bone.

The radial Side is very ſmall and near the Baſis, being articulated with the Os Pyramidale; the reſt of this Surface is without Cartilage. The cubital Side is double, anſwering to a like Side in the Os Unciforme with which it is articulated.

The exterior Surface, which forms a Portion of the concave Side of the Carpus, is broad, rough, and uneven, for the Inſertion of Ligaments. The interior Surface is likewiſe rough, but narrower, and round both Surfaces are ſeveral Depreſſions, which in the natural State, are filled with ſmall Glands, Ligaments, &c.

In the fourth Bone of the ſecond Row, we are to conſider the Body, and hooked or unciforme Apophyſis, from whence it has the Name of Unciforme.

This Apophyſis, one of the four Eminences, on the carpal concave Side, is flat, and the concave Side of its Curvature, turned toward the Os Magnum.

The exterior Surface of its Body is rough, and in ſome meaſure triangular. It completes the convex Side of the Carpus, and toward the Ulna terminates in a ſmall Tuberoſity, which is all the cubital Side of this Bone.

It has three articular or cartilaginous Sides, one radial, one brachial, and one digital.

The radial Side is double, anſwering to the cubital Side of the Os Magnum. The brachial Side is very oblique, ſome part of it being a little concave, the reſt a little convex; anſwering to the digital Side of the Os Cuneiforme. The digital Side is double, or diſtinguiſhed into two Parts,

by

by a sigmoïd angular Line, for its Articulation with the two last Bones of the Metacarpus.

The Bones of the Carpus are articulated with each other by Arthrodia; but the first Row forms a sort of Ginglymus with the second, because the Head of the Os Magnum may turn in the cotyloïd Cavity of the first Row, while the two first Bones of the second Row slide upon the digital Side of the Os Scaphoïdes; and the Os Unciforme in the same manner, on the Os Cuneiforme.

When all these Bones are in their natural Situation, a transverse Depression is formed on the convex Side of the Carpus, by which the two Rows are distinguished. This Depression appears most between the Os Scaphoïdes and the three last Bones of the second Row, and looks like a kind of Fold, by which the second Row is thrown back upon the first.

The four Eminences on the concave Side of the Carpus, are for the Insertion of a strong transverse Ligament. The interior Substance of all these Bones is spongy, and their Surfaces are not very compact.

Ossa Metacarpi, or the Metacarpal Bones.

The Metacarpus is the second Part of the Hand, situated between the Carpus and the Fingers. The Antients, who called the Carpus, Brachiale, from whence the Word Bracelet seems to be derived, termed the Metacarpus, Post Brachiale.

The Metacarpus consists of four Bones, one Side of which forms a broad Cavity, called the Palm of the Hand; the other a gentle Convexity, called the Back of the Hand. The antient Anatomists

tomifts reckoned five Bones in the Metacarpus, including that Bone, which is now looked upon, as the firft Phalanx of the Thumb.

The Bones of the Metacarpus, are long thicker at the Extremities, than in the Middle, and of unequal Length and Bignefs. The firft is the largeft, the reft are leffened by Degrees in all their Dimenfions. The two firft are fometimes, though very rarely, equal.

Each Bone is divided into the Extremities and middle Part; or into a Bafis, Body, and Head. The Bafes are angular, and turned toward the Carpus; the Heads, rounded like Condyles, and turned toward the Fingers. Both are covered with Cartilages, and the Heads remain for a long Time very diftinct Epiphyfes.

The Bafes are narrow and almoft angular, toward the Palm of the Hand; toward the Back of the Hand, their Breadth is confiderable, but on the other two Sides, they are very broad; and there they have fmall articular Sides, which I call lateral Sides. The Heads are flatted on the two Sides, which anfwer to the lateral Sides of the Bafis, and their greateft Convexity is turned toward the Palm of the Hand, terminating in two obtufe Points.

Several Sciffures and Foffulæ, break in upon the lateral Sides; and the flat Sides of the Heads are a little depreffed; a fmall Tubercle arifing in the Middle of each Depreffion.

The Body of each Bone is contracted, of a triangular Figure, and diftinguifhed into three Sides, whereof one is external and a little convex, contributing to make the Back of the Hand; the other two internal, and a little concave, one being turned obliquely toward the Radius, the other toward the Ulna. Thefe three Sides are feparated by the fame Number of Angles, and that

that Angle which parts the two internal Sides is ſharp. It is by theſe two Sides, and the Angle between them, that the Hollow of the Palm of the Hand is formed.

Os Metacarpi Indicis, or the first metacarpal Bone, is longer, thicker, and bigger, than any of the reſt, and ſupports the fore Finger.

Its Baſis is a little concave, anſwering to the digital Side of the Os Pyramidale of the Carpus. On the exterior Margin there is a ſmall angular Sciſſure; and on the cubital Margin of the Baſis, a ſmall lateral Side, which is articulated with the Baſis of the ſecond Bone. The interior Margin is terminated laterally by an oblique Angle, which is articulated with the contiguous Angle in the Baſis of the Os Magnum. Round the Baſis are Inequalities and Depreſſions for the Ligaments and articular Glands.

Exteriorly, the Body of the Bone is broader toward the Head, than toward the Baſis.

Os Metacarpi medii Digiti, or the ſecond Bone, ſupports the middle Finger, and has this peculiar to it, that its Baſis is very oblique, terminating at the exterior Margin, by an angular Apex, turned toward the firſt Bone. By the triangular Side of its Baſis, it is articulated with the Baſis of the Os Magnum; and by its lateral Sides, with thoſe of the firſt and third Bones of the Metacarpus.

Os Metacarpi Digiti annularis, or the third Bone, ſupports the Ring Finger, being leſs than the firſt and ſecond. Its Baſis is irregularly triangular, and proportionably leſs than the two former; and by the principal Side thereof, it is articulated with the firſt half of the Side of the Os Unciforme. The ſmall lateral Sides of the Baſis join thoſe of the ſecond and fourth Bone of the Metacarpus.

Os

Os Metacarpi minimi Digiti, or the fourth Bone, ſupports the little Finger. The principal Side of its Baſis, inſtead of being triangular, as in the other Bones, is all of an equal Breadth, a little oblique, and ſome Part of it gently convex, the reſt gently concave, and articulated with the ſecond Half of the Side of the Os Unciforme.

By its lateral Sides, it joins the correſponding Side of the Baſis of the third Bone, but in a much looſer manner, than in the other Articulations of the like kind. In the oppoſite Side there is ſmall Tuberoſity.

Ossa Digitorum, or the Bones of the Fingers.

The Fingers, make the third Part of the Hand, and terminate the whole ſuperior Extremity. They are Five in Number in each Hand; called the Thumb, the Fore Finger, the Middle Finger, the Ring Finger, and the Little Finger.

They may be ſaid, in general, to repreſent the ſame Number of compound, long, ſmall bony Pyramids, convex on one Side, gently concave on the other, and joined by their Baſes to the Carpus and Metacarpus, from whence they diminiſh gradually, and terminate in a ſort of ſmall Heads.

Magnus Digitus, or the Thumb, is the biggeſt of all the Fingers; next to that is the third, called the long Finger; the ſecond and fourth are ſhorter than the third, the fourth being a very little longer than the ſecond; the fifth is the ſmalleſt of all.

Each Finger conſiſts of three Pieces, called Phalanges; the firſt of which is longer and thicker than the ſecond, and the ſecond than the third. Each Phalanx is divided in the ſame manner as an intire Finger, into a Baſis, middle Portion,

tion, and Head; into two Sides, one convex, the other concave; and into two Margins. The Basis of the Phalanges remain Epiphyses for a long time, as well as the Heads of the metacarpal Bones.

The first Phalanx of the Thumb is not like those of the other Fingers. Antient Authors reckoned it among the Bones of the Metacarpus, which it resembles very much, and then they counted five metacarpal Bones, allowing only two Phalanges to the Thumb. The convex Side of this Phalanx is very much flattened, and broader toward the Head, than toward the Basis. On the concave Side, is a kind of angular Line, which, in some measure, distinguishes it into two Parts; its Head is like those of the metacarpal Bones, only flattened at Top.

The articular Side of its Basis is proportioned to the digital Side of the Os Trapezium, of the Carpus; and framed in such a Manner, as that the sigmoïd Cavities and Eminences, in both Bones, cross each other. This Articulation has something very particular in it. It is a kind of double Ginglymus, which readily allows the Flexion and Extension, Adduction and Abduction, but with Difficulty permits the oblique Motions, because then the two Sides run counter to each other.

The Head and Basis carry, for a long Time, the Marks of Epiphyses; and for all these Reasons, this Bone may be reckoned a metacarpal Bone degenerated.

The second Phalanx of the Thumb is shorter than the first; its Body convex, or Semi-cylindrical on one Side, flat on the other, and contracted between the Margins. The articular Side of the Basis is a little concave, and surrounded near the Margins by small Tuberosities, as also near the Angle of the Phalanx. The Head is a regular

Portion

Portion of a Trochlea, which projects more on the concave, than the convex Side; and on both Sides there is a ſmall Foſſula and ſome Inequalities, in form of Tubercles. On the flat, or concave Side of the Phalanx, are two rough Lines, one near each Margin, which are often deſtroyed in cleaning the Bones.

They are the Impreſſions, or Marks, of the articular Vaginæ, which ſhall be explained in deſcribing Cartilages and Ligaments.

The Connection of this Phalanx with the firſt, is by a kind of Arthrodia, or by a flat Enarthroſis, which permits a Motion in ſeveral Directions, though more limited than in other Articulations of the ſame kind. It is articulated with the third, by a very perfect Ginglymus.

The third Phalanx of the Thumb, repreſents the half of a ſort of Cone; cut longitudinally, and by connecting it to the ſame Bone of the other Thumb, an intire Cone is formed. The convex Side is more even than the flat Side; and on each Margin, there is a Tuberoſity near the Baſis. The Baſis has two concave Sides, which form a Ginglymus, with the Head of the ſecond Phalanx. The Head ſmall and flat, ending in a rough Semicircular Border, which on the flat Side of the Bone, repreſents a Horſe Shoe.

The other four Fingers in general and their Phalanges in particular, are all nearly of the ſame Structure, differing chiefly in Size. The fore * and ring Fingers †, are almoſt equal, only the fore Finger is generally a little bigger, and ſometimes a little ſhorter than the other. The middle Finger ‡ is the longeſt, and the little Finger ‖ the

* Demonſtrationes vel Salutaris. † Annularis vel Cordis Digitus. ‡ Impudicus Digitus. ‖ Auricularis vel Minimus.

leaſt,

least, almoſt the ſame Proportions are to be obſerved in the Phalanges.

The firſt Phalanges of theſe four Fingers are made nearly in the ſame Manner, with the ſecond of the Thumb; only they are longer in Proportion, flatter on the concave Sides, and more rounded on the convex Sides. The Margins of the flat Sides have the ſame rough Line, as the ſecond Phalanx of the Thumb: Their Baſes are concave, for their Articulation with the Heads of the metacarpal Bones, and their Heads are like Pulleys; as in the ſecond Bone of the Thumb.

The ſecond Phalanges are ſhorter, narrower, and thinner, than the firſt. Both Phalanges are gently incurvated, and reſemble each other in Structure, except that the ſecond contracts by degrees from their Baſis, to the Heads, which are very ſmall; and their Baſes, have a double Cavity for their Articulation by a Ginglymus, with the Heads of the firſt Phalanges. Their flat Sides have the ſame rough Lines already mentioned.

The third Phalanges are in every thing like that of the Thumb, except that they are ſmaller; each of them being proportioned to the Finger they belong to.

It is to be obſerved concerning all the Phalanges, that their Baſes have ſmall Tuberoſities, and their Heads, except thoſe of the laſt Phalanges, have on each Side, a roundiſh ſort of Foſſula, bordered with ſmall Eminences.

LECTURE X.

The CARTILAGES and LIGAMENTS of the SUPERIOR EXTREMITY.

CARTILAGES OF THE BONES OF THE SHOULDER.

THE Scapula, in many Subjects, has a ſmall cartilaginous Border along its whole Baſis, which, in Children, is remarkable enough; but in full grown Subjects it diſapears.

The glenoïd Cavity of this Bone is covered with a Cartilage, which is thicker toward the Circumference than in the Middle, and a little raiſed above its Margin. This Thickneſs of the cartilaginous Circumference makes the Cavity greater than it appears in the Skeleton; and ſometimes, in lieu thereof, there is an additional Margin, which is thick at the Circumference of the Cavity, thin towards the Bottom, and very narrow. It is of a pliable ſlippery Subſtance, yet ſomewhat different from that of a Cartilage, reſembling, in ſome Meaſure, the Margin of the cotyloïd Cavity of the Os Innominatum.

The ſmall cartilaginous Surface of the Acromium, mentioned in the Deſcription of dry Bones, is thicker in the natural State, and very little convex.

The ſmall triangular Surface, at the Extremity of the Spine of the Scapula, near its Baſis, is covered with a very thin, ſmooth, cartilaginous Lamina; as being tranſparent, it does not appear very white.

There are no other Cartilages commonly found in the Scapula, though we ſometimes obſerve in dry Bones, ſeveral Places which ſeem to have been cartilaginous, but this is owing to the dried Remains of Ligaments and Tendons.

The ſternal Extremity of the Clavicle is cruſted over with a Cartilage, which is a little convex, and covers its whole triangular Surface; beſides which it has another moveable common Cartilage, which is explained together with thoſe of the Sternum.

The ſmall cartilaginous Surface of the humeral Extremity of the Clavicle, anſwering to that of the Acromium, is much thicker in freſh, than dry Bones; and appears, like that of the Acromium, to be a little Convex.

Between theſe two Cartilages of the Clavicle and Acromium, there is in ſome Subjects, a thin inter-articular Cartilage, very ſmooth on both Sides.

Ligaments of the Bones of the Shoulder.

The Articulation of the Acromium with the Extremity of the Clavicle, is ſtrengthened quite round by ſeveral ſmall ſtrong Ligaments, which go from one Bone to the other. Theſe Ligaments lie very near each other, and are ſo tightly braced over the Joint, as to hide it altogether, and they appear more like a cartilaginous Covering, than a ligamentary Texture. The internal Surface of theſe Ligaments is lined with the articular Capſula.

When the ſmall inter-articular Cartilage is found, its whole Circumference is connected to theſe Ligaments.

The Articulation of the Clavicle with the Sternum, is ſituated by ſeveral Ligaments fixed by one End, round the pectoral Extremity of the Clavicle, near the Edge of the triangular Surface, and from thence, paſſing over the inter-articular Cartilage, are inſerted by the other End in the Sternum, in the manner hereafter to be related.

There is a long, narrow, ſtrong Ligament, which goes from one Clavicle to the other, behind the Furca of the Sternum, being fixed to the internal Angle of the contiguous Extremities of the Bones, which may be called the inter-clavicular Ligament.

The Cervix of the Scapula, at a ſmall Diſtance from the Margin of the glenoïd Cavity, gives inſertion to the capſular Ligament or mucilaginous Capſula, and to the articular Ligaments of the Articulation of the Scapula with Humerus.

Beſides theſe articular Ligaments of the Scapula, there are three ligamentary Cords fixed to the Tuberoſity of the coracoïd Apophyſis; two of which, by their other Extremities, are inſerted in the oblique Eminence on the inferior Side of the humeral Extremity of the Clavicle; the third, under the Acromium. There is likewiſe a thin, flat, broad Ligament, reaching between the Criſta of the Spine of the Scapula and the Margin of the inferior Coſta.

Cartilages of the Os Humeri.

The Cartilage, by which the Hemiſphere of the Os Humeri is covered, is gradually thicker toward the Middle, than toward the Margin.

The four Surfaces of its Tuberoſities, which appear cartilaginous in dry Bones, ſerve only for

the Infertion of the Tendons of four Mufcles, which move the Humerus on the Scapula.

The Sinuofity, between the two Tuberofities, is partly covered by a thin Cruft, which appears rather ligamentary than cartilaginous; and partly by a tendious Stratum.

The Trochlea and fmall Head of the inferior Extremity of the Humerus are covered by a common Cartilage, in which the fame Proportion of Thicknefs is obfervable, as in that of the fuperior Extremities. This is moft common to all the convex articular Cartilages.

The Foffulæ, near the Pulley and fmall Head; are covered with a kind of thin Cartilaginous.

Ligaments of the Os Humeri.

The capfular or mucilaginous Ligament loofely furrounds the whole Articulation of the Scapula with the Head of the Humerus. Form its Infertion round the Margin of the glenoïd Cavity already mentioned, it is continued over the Hemifphere of the Head of the Humerus, and fixed near its Margins, towards the mufcular Surfaces of the great and fmall Tuberofities.

Afterwards parting from them on both Sides, in the large Space left between the two Tuberofities, that is, between the fmall Tuberofity, and the inferior Surface of the great Tuberofity, it defcends gradually on the Cervix of the Bone below the inferior Part of the cartilaginous Hemifphere.

In all its Courfe, the Capfula is clofely fixed in the Bone, except in the fmall Space left between the two Tuberofities, that is at the Sinus already mentioned; where it forms a Production like the Tube of a Funnel, proportioned to the Capacioufefs of the Sinuofity, and ftrongly fixed in the fuperior Portion thereof. This membranous Tube is

the Vagina of the inter-articular Tendon of the Biceps, which ſhall be deſcribed in the Treatiſe of the Muſcles.

The true Ligament of this Joint ſeems to be formed of two ſorts of Ligaments cloſely united; viz. of a capſular Ligament which ſurrounds the whole Articulation, and of ſeveral true Ligaments which run over, and cloſely adhere to the former at different Diſtances.

Thus the Capſula, or mucilaginous Capſula of this Articulation is in part ſtrongly united to four flat Tendons inſerted in the two Tuberoſities; and in part covered by true ligamentary Membranes, which, between the four Tendons, and on both Sides of the firſt and laſt, form a conſiderable Thickneſs. The reſt of the Space, between the firſt or ſuperior Plane of the great Tuberoſity, and the ſmall Tuberoſity is ſo little provided with ligamentary Fibres, that it has been believed to be altogether without them; and Anatomiſts have ſatisfied themſelves with telling us, that in theſe Places the orbicular Ligament is very rough externally, but ſhining and ſmooth internally.

The inter-articular Tendon of the Biceps, which has been already mentioned in ſpeaking of the Production of the capſular Ligament of the Head of the Humerus, and which is contained in the Articulation, much after the ſame Manner as the inter-articular Ligament of the Head of the Femur, called improperly Ligamentum Teres, might be properly enough deſcribed in this Place, but I chuſe to refer it amongſt the Muſcles.

On the Body of the Humerus, there are two particular Ligaments which Winslow terms Inter-muſcular or Lateral; they are long, flat, thin, ſtrong, and narrow, fixed by one Margin, along the two inferior Thirds of the Bone; and reaching to both Condyles. They are braced pretty tight,

and are very narrow ſuperiorly, but broader toward the Condyles.

The inferior Extremity of the Humerus, is connected to the Bones of the Fore-arm, by the Faſciculi of ligamentary Fibres, one fixed to the internal Condyle, the other to the external.

Each Faſciculus is compoſed of Fibres, cloſely united at the Condyle, and afterwards parting in diſtant Membranes like a Gooſe's Foot.

The capſular Ligament is fixed to the Condyles and theſe cover them; and afterwards it is fixed round both Sides of this lower Extremity, above the Foſſulæ. Its Inſertion in the Sides is curvated; ſo that it is there at a much greater Diſtance from the Articulation than the Condyles. The Foſſulæ are ſlightly lined over with a cartilaginous Subſtance.

This Capſula appears to be ſtrengthened by a Ligament, the Fibres whereof croſs each other in different Directions; but we muſt not take for ligamentary Filaments, ſome tendinous Fibres of Muſcles to which the Capſula adheres very cloſely: It appears larger and looſer when the Muſcles are ſeparated from it, than in its natural State when cloſely united to the Muſcles.

Cartilages of the Bones of the Fore-arm.

The two ſigmoïd Cavities in the ſuperior Extremities of the Ulna are covered by a Cartilage common to both, which is a little interrupted about the middle of the Margin of the Cavities, by the tranſverſe Sciſſures mentioned in the Treatiſe of dry Bones. This cartilaginous Cruſt ſeems to be thicker at the Margins than in the Middle.

The inferior Extremity, or ſmall Head of the Ulna, is cruſted over by a Cartilage, round its cylindrical Border, in the Sciſſure near the ſtyloïd

Apophyſis

Apophyſis, and for ſome Space on the Apophyſis itſelf.

The Cartilage, which covers the Head of the Radius, is likewiſe extended over the cylindrical Margin thereof; and a lateral Portion of the muſcular Tuberoſity immediately below the Cervia, is alſo covered with a thin ſhining Cartilage.

The lateral Semi-ſinus of the Baſis of this Bone, appears likewiſe to be cruſted over with a cartilaginous prominent Line. The natural Sciſſure of the Baſis is likewiſe covered by a Continuation of the ſame Cartilage.

At the Baſis of the Radius there is alſo a particular additional Cartilage, or triangular Production, longer than it is broad, very thin, and rather flat than concave on both its ſmooth Sides. It is fixed by its Baſis, or ſhorteſt Side, to the lateral ſigmoïd Sciſſure of the Baſis of the Radius, in ſuch a Manner, that one Side of it is on a Level with the large cartilaginous Surface of the Baſis of the Bone, and its Apex directly oppoſite to the ſtyloïd Apophyſis. The other Side touches the flat Extremity of the ſmall Head of the Ulna, but is not fixed to it; and may be termed the inter-articular Cartilage of the Articulation of the Wriſt. It is tied to the Radius by very ſhort Ligaments, and ſliding on the ſmall Head of the Ulna, it follows all the Motions of the Radius.

It is therefore a ſort of particular Production of the inferior Side of the Baſis of the Radius, and fills in the natural State, the void Space, which, in the Skeleton, appears between the End of the Ulna and the neighbouring Bone of the Carpus.

Ligaments of the Bones of the Fore-arm.

Some of theſe Ligaments, are common to them with the Humerus, others with the Bones of the Hand; and ſome are proper. Theſe laſt

are two one called the inter-osseous Ligament of the Fore-arm, and another which may be termed the coronary Ligament of the Radius. To these may be added the annular Ligaments, which only serve for the Passage of Tendons and other ligamentary Expansions, which may be named Muscular Ligaments.

The inter-osseous Ligament of the Fore-arm is very like that of the Leg. It is fixed by one Margin, along the acute Angle of the Ulna, and by the other along that of the Radius. It is principally composed of two very strong Laminæ of Fibres, which cross each other at oblique Angles, and leave Apertures at different Distances for the Passage of the sangueous Vessels.

This Ligament ties the two Bones closely together, and the two Laminæ serve for the Insertion of several Muscles.

In the Supination of the Hand, it is very tightly braced; but in Pronation, it is folded a little longitudinal.

The coronary Ligament of the Radius is a sort of ligamentary Capsal, surrounding the circular Circumference of the Head of that Bone, reaching from one Side of the small lateral sigmoïd or transverse Cavity of the Ulna to the other, circularly about three Quarters.

It is very strong, and comes near the Solidity of a Cartilage. The Side next the Radius is very smooth, and though it connects that Bone very closely to the Ulna, yet it leaves it room enough to to turn, in the Motions of Pronation and Supination.

The capsular Ligament of the Articulation of the Cubitus, runs down from its Insertion in the Humerus, already described, and is fixed in the Olecranum, round the Margin of the great sigmoïd Cavity, including both the Apex of the Olecranum and of the coronoïd Apophysis.

It

It likewise runs over the Head of the Radius, and is fixed to the coronary Ligament, quite round. Thus it completely surrounds the Articulation of the three Bones, and serves to contain the mucilaginous Liquor furnished by the Glands and fatty Substance, both which are found in the greatest Quantities near the Extremity of the Ulna.

The true common Ligaments, by which the Os Humeri is connected to the Bones of the Fore-arm, called lateral Ligaments, are the two Fasciculi, which, after being inserted in its Condyles, are expanded like a Goose's Foot. That which is fixed in the interior Condyle, may be called Brachio-Cubitale, and the other Brachio-Radiale.

The brachio-cubital Ligament descending over the Capsula, to which it closely adheres, below the great Margin of the Trochlea of the Humerus is inserted like Radii (of which its other Extremity fixed in the Condyle is the Center) on the Side of the great sigmoid Cavity of the Ulna. It is covered externally by several Tandons, which adhere closely to it, and seem to strengthen it.

The brachio-radial Ligament is disposed much after the same Manner, but is of a greater Extent. It is expanded from the external Condyle of the Humerus, as for a Denter, and is inserted round the coronary Ligament, and from thence down to the Cervix of the Radius, and also in the adjacent Parts of the Ulna. Through all this Passage, it covers the capsular Ligament, and is covered by several Tendons, adhering closely to both.

Of the Ligaments by which these Bones are connected to those of the Hand, one is like a roundish Cord, fixed in the styloid Apophysis of the Ulna, and from thence passes directly over the Os Cuneiforme of the Carpus, in which, and in other Bones it is inserted in the Manner we shall afterwards

wards explain: Another pretty broad Ligament is fixed in the Apex of the Radius, and by its other Extremity with the Bones of the Carpus.

From this ſtyloïd Ligament of the Radius, along each Margin of the Baſis of that Bone are Ranks of ligamentary Fibres lying much in the ſame Direction with the Ligament itſelf, and continued all the way to the ſtyloïd Ligament of the Ulna; thoſe neareſt the Ulna incloſe the inter-articular Cartilage of the Baſis of the Radius, and near the ſtyloïd Ligament of the Ulna, there is a particular Faſciculus inſerted in the Apex of that Cartilage.

All theſe Ligaments ſurround and cover the capſular Ligament ſo cloſely, that they can hardly be diſtinguiſhed from it. The Capſula is likewiſe in Part covered by a Portion of a great oblique Ligament, which being by a very broad Inſertion fixed in the large Extremity of the Radius, about two Fingers Breadth above the ſtyloïd Apex, afterwards croſſes obliquely, partly over the convex Side of the baſis Radii, and partly over that of the Carpus, and then turning toward the Os Orbiculare, is inſerted therein. It is called the external tranſverſe Ligament of the Carpus; and may likewiſe be named the great oblique Ligament of the Wriſt.

There are ſeveral ſmall annular Ligaments placed at different Diſtances on the convex Side of the Baſis Radii, from its ſtyloïd Apex to its Articulation with the Extremity of the Ulna. They are at leaſt ſix in Number, ſome of them being often double or triple.

The firſt, is fixed in the ſtyloïd Apex; the ſecond, in the Sinuoſity near that Apex; the third, in the ſmall narrow middle Sinuoſity; the fourth, in the Sinuoſity next the former; the fifth, in the ſemi-lunar Sciſſure of the Baſis, at its Articulation

with

with the Ulna; and the fixth in the Extremity of the Ulna, near the ftyloïd Apophyfis.

Thefe particular Ligaments are almoft covered by the great oblique Ligament already mentioned, and are fixed as ftrongly in it by one Side, as they are in the Bones, by the other. They are all very ftrong, and their concave Sides, ferving for Fræna to the Tendons of feveral Mufcles that pafs over them, are very fmooth, and accompanied with thin mucilaginous Vaginæ, which fhall be defcribed with the Mufcles.

To thefe we might add the ligamentary Expanfions, with which feveral Mufcles are covered, and feparated from each other, as by fo many diftinct Septa, which are all very thick and ftrong, where they are inferted in the Bones.

One kind of them may be termed ligamentary or mufcular Vagniæ, the other ligamentary Septa, inter-mufcular Ligaments, &c. but the Defcription of them muft be referred to that of the Mufcles.

Cartilages of the Bones of the Hand.

All the Bones of the Carpus, Metacarpus, and Fingers, are crufted over with Cartilages at thefe Places, which I termed cartilaginous Surfaces in the Treatife of dry Bones; but in frefh Bones they are thicker, fofter, and whiter, than in the Skeleton.

In adult Subjects, their Figure remains the fame in both, but it changes in the dry Bones of younger Subjects, and in thofe of Children it is quite different. The Impreffions and Sciffure in which the mucilaginous Glands are lodged, are moft fenfible in the Cartilages of frefh Bones, becaufe of their Thicknefs.

Ligaments

Ligaments of the Bones of the Hand.

The Ligaments of the Carpus are very numerous. Some of them tie each Bone to one or two adjacent Bones in the ſame Rank; and theſe are compoſed of a great Number of Filaments, but ſo very ſhort as to allow theſe Bones only a ſmall Degree of Motion. Some of them tie the Bones of one Row to thoſe of the other; which are likewiſe made up of many Filaments, but not ſo ſhort as the former, and therefore allow theſe Bones a more manifeſt Motion, as we ſee in Flexion of the Wriſt.

Laſtly, There are other Ligaments of the Carpus, by which the three firſt Bones of the firſt Row are connected to the Bones of the Fore-arm; and to theſe may be added the Ligaments by which the Bones of the ſecond Row are joined to thoſe of the Metacarpus, and firſt Phalanx of the Thumb.

We have already deſcribed all the Ligaments belonging to the Articulation of the Carpus with the Bones of the Fore-arm, except their Inſertions in the Carpus. The ſtyloïd Ligament of the Radius is fixed round the neighbouring Tuberoſity of the Os Scaphoïdes. The ſtyloïd Ligament of the Ulna is fixed firſt in the Os Cuneiforme, and then in the Os Uneiforme, from whence it is a little ſtretched over the fourth Bone of the Metacarpus.

The Ligaments which lie between the two former, round the Baſis of the Radius, and a ſmall Portion of the Head of the Ulna, are fixed round the common Convexity of the three firſt corporal Bones, as is alſo the mucilaginous Capſula by which theſe Ligaments are lined.

Beſides all theſe ſmall ſhort Ligaments belonging to each Bone in both Rows, the rough Surfaces of all the Bones, eſpecially thoſe which form the Convexity of the Carpus, give Inſertion to a great

great many ligamentary Fafciculi, extended over, and clofely united to the former fmall Ligaments, and ferving probably to ftrengthen them. Some Fafciculi of the fame kind are found on the concave Side of the Carpus, but they are fewer in Number, and not fo ftrong.

There is likewife a confiderable Ligament, called the interior tranfverfe Ligament of the Carpus. It was formerly called an annular Ligament, and may ftill very properly retain that Name, in the Senfe already explained when we fpoke of Ligaments in general.

The Bones of the Metacarpus, befides the fhort Ligaments by which they are tied to the fecond row of Bones of the Carpus, have feveral others, by which both their Bafes and Heads are connected together.

The Bafis of the third and fourth Bones are not fo clofely tied as the reft, and therefore they have a very fenfible Motion, which, however, is greater in the fourth, than in the third.

The Heads of thefe Bones are firmly tied to each other, by a ftrong tranfverfe Ligament fituated in the Palm of the Hand, and fixed by diftinct Productions, in the neighbouring Part of the Heads, in fuch Manner as to form in the Spaces between the Heads, a kind of perforated Fræna, through which the Tendons of the Flexor Mufcles of the Fingers have a free Paffage; and thefe Fræna are alfo fupported by aponeurotic Expanfions, which fhall be defcribed in the Treatife of the Mufcles.

The firft Phalanx of the Thumb, is fixed to the Os Trapezium, by fhort Ligaments, which pafs obliquely over the Articulation. The firft Phalanges of the other Fingers are articulated to the Heads of the metacarpal Bones, almoft in the fame Manner, and by Ligaments like the former, which

which are ſtrengthened by adhering to the tranſverſe Ligament already mentioned. The ſecond Phalanx of the Thumb is articulated to the firſt by Ligaments of the ſame kind.

The third Phalanx of the Thumb is articulated to the ſecond; the ſecond Phalanges of the other Fingers to the firſt, and the Third to the Second, by lateral Ligaments, almoſt in the ſame Manner as the Bones of the Fore-arm, to the Humerus, that is, theſe Ligaments ſpread from a Point fixed in the lateral Tubercles of the Heads of the Phalanges, and are inſerted by their other Extremity like Radii in the Bones of the contiguous Phalanges.

The two Phalanges of each Finger have a very ſtrong ligamentary Vagina inſerted in the rough Lines or Ridges on their flat Sides. Theſe Vaginæ are lined with a mucilaginous Membrane, which runs like a Tube from one Phalanx to the other, over the Articulation. They ſerve for Fræna to the Flexor Muſcles of the Fingers, the Tendons of which paſs through them.

Observations.

The particular Situation and Uses of the Bones of the Superior Extremities.

The Hand is generally repreſented in Skeletons and Figures as lying in the ſame Plane, and in the ſame longitudinal Direction with the Bones of the Fore-arm. This gives a very falſe Idea of its true Situation, which, with reſpect to the Fore-arm, is oblique in two Reſpects. The Back of the Hand is inclined upon the convex Side of the Carpus, and makes an Angle with the Fore-arm, and beſides, the fourth Bone of the Metacarpus is inclined towards the Ulna in particular; in a Word, the Breadth of the Hand makes an Angle with the Breadth

Breadth of the Fore-arm, and the Thickneſs of the Hand at the ſame Time, with the Thickneſs of the Fore-arm. I mean here that Part of the Fore-arm, which is next the Hand.

This is owing to the Structure and Situation of the Bones of the Carpus, and to their Connection with thoſe of the Fore-arm. Firſt the two Rows of theſe Bones make a ſort of tranſverſe Fold on the convex Side of the Carpus, and the articular brachial Sides of the two firſt Bones of the firſt Row are turned a little toward the ſame convex Side of the Carpus. Which obliges the whole Hand to be a little bent back in its natural Situation. Secondly, the Margin of theſe Bones next the Ulna is much ſhorter then that next the Radius, which makes the cubital Margin of the whole Hand incline to that Side.

By not conſidering this, a large void Space is commonly left in Skeletons, between the Extremity of the Ulna and the Os Cuneiforme of the Carpus. We ought likewiſe to obſerve that the Margin of the Metacarpus next the Ulna is ſhorter than the other, ſo that in the Metacarpus a ſmall and great Margin may as juſtly be diſtinguiſhed as in the Carpus.

In this oblique and natural Situation of the Hand, the Fingers being extended and a little ſeparated, the Extremity of the fore Finger will be found to anſwer to the Interſtice between the Bones of the Fore-arm, and if in this Situation we make alternately the Motions of Pronation and Supination, the Extremity of the fore Finger will be found to be in ſome Meaſure the common Center of theſe Motions.

This Deſcription of all the Bones of the Hand is moreover very well contrived, to give it ſeveral kinds of Attitudes; for by Means thereof, it may be lengthened, flatted, ſhortened, and contracted.

The

The Hand is lengthened or widened, and flatted by extending all the Fingers and turning back the Thumb, which is what is called extending or opening the Hand. It is ſhortened by bending all the Fingers; whether in what is called cloſing the Fiſt, or in graſping any thing; and to this the Situation of the Thumb, and the oblique Diſpoſition of the Bones of the Metacarpus and Fingers contribute in a particular Manner. And as in this Caſe the Thumb counter-balances all the other Fingers, the Articulation of the firſt Phalanx thereof, with the Os Trapezium, appears to be rendered more firm and ſteady, by partaking a little of the Nature of a Ginglymus, without hindering its other Motions. Laſtly, The Hand is contracted, and made into a ſort of Sulcus or Furrow, by the Adduction of the Thumb, and the eaſy Motion of the fourth metacarpal Bone already mentioned. And if, at the ſame time, we bend the Fingers and preſs them cloſe together, we both ſhorten and contract the Hand, and thereby form a Hollow, which is called Diogenes's Cup.

In the Fingers we ought likewiſe to remark, that though the Articulation of the ſecond Phalanx of the Thumb, and firſt Phalanges of the other Fingers be moveable in many Directions, and framed nearly in the ſame Manner as that of the Humerus with the Scapula; yet theſe Phalanges cannot be moved round their Axis. This is not owing to their Conformation, but to the Want of proper Muſcles, as we ſhall ſee afterwards. The ſame thing cannot be ſaid of the firſt Phalanx of the Thumb, becauſe though it had proper Muſcles, yet the kind of half Ginglymus, by which it is articulated, would not allow of ſuch a Motion.

The Thumb is ſituated differently from the other Fingers. The Fingers, both with Reſpect to their Sides and Margins, have in their natural Situation

Situation, nearly the ſame Direction with the Plane of the Metacarpus. The Thumb, being in its natural Situation, and free from the Action of all its Muſcles, its convex Side anſwers to the convex Side of the Radius, and its flat Side is turned toward the little Finger; and the firſt Phalanx makes a hollow Angle with the Radius, and a prominent Angle with the ſecond Phalanx; but both this and the third Phalanx lie in a ſtreight Direction like that of the Fore-arm.

The Carpus is the Baſis and Center of all the Motions of the Hand, except that of Rotation: by Means thereof we can bend the Hand in all Directions, but with more Eaſe toward the Sides and Margins than any other way. The four Bones of the ſecond Row may have a ſmall Degree of Motion on the firſt, ſuch as Ginglymus can allow of.

The Radius is in a manner the Handle of the Hand, and it is chiefly by means thereof, that we can move it reciprocally, as on an Axis turning either Margin of it toward the Body. When the radial, or great Margin is turned to the Body, this Motion, or Attitude is termed Pronation; and when the cubital, or ſmall Margin is toward the Body, it is termed Supination. In the natural and moſt ordinary Situation of the Hand, the Palm is turned toward the Body, and not the Margins.

This Diſpoſition of the Hand determines the true Situation of the Radius, which is not on one Side of the Ulna in a parallel Direction, as the Figures of Skeletons commonly repreſent it, but the Radius croſſes the Ulna obliquely in ſuch a manner, as that the ſtyloïd Apophyſes, in both Bones, are directly over againſt each other. This is its true natural Situation. The Radius being bent, may be ſtill further croſſed over the Ulna, than in its natural Situation; and this happens in

Pronation, but in Supination it is parallel to the other Bone.

The Ulna ſupports the Handle of the Hand, without being itſelf articulated with it. Two lateral Ginglymi and very ſtrong Ligaments connect the Radius cloſely with it; ſo that in the moſt violent Motions, theſe two Bones cannot be ſeparated. When we puſh or preſs any thing with the Hand, the whole Force is ſuſtained by the Radius, the Baſis of which ſupports the Wriſt, and its concave Head is ſtrongly preſſed againſt the ſmall inferior Head of the Os Humeri, the oblique Direction of the Pulley of the Ulna is the Reaſon that, in bending the Fore-arm upward, the Extremity of that Bone is naturally turned toward the Thorax, and not without Difficulty toward the Articulation of the Scapula.

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LECTURE XI.

The INFERIOR EXTREMITIES.

OS FEMORIS.

THE FEMUR is the biggeſt and longeſt Bone of the Skeleton. Its Figure comes near that of a Cylinder, and it is a little bent at the Middle.

It lies in the ſame Direction with the Trunk; only a little obliquely, in ſuch a Manner, as that the ſuperior Parts of the two Bones are at a greater Diſtance from each other, than the inferior.

In the ſuperior Extremity, we are to conſider the Head, Cervix, and two Tuberoſities, named Trochantes Major and Minor.

The Head is rounded like a Globe, or Ball, and covered with a very ſmooth Cartilage. Its Situation is obliquely exteriorly, and a little anteriorly; ſo as that the greateſt Portion of its Convexity lies ſuperiorly, and the ſmalleſt inferiorly; and the Cartilage extends farther on the anterior and poſterior Sides, than on the other Sides.

A little below the Middle of its Convexity, there is a Foſſula, nearly of a ſemilunar Figure, in which a Ligament is inſerted in the natural State. The Femur of the Head is an Epiphyſis in Children, and in ſome Subjects remains ſuch for a long time,

and is therefore liable to be ſeparated from the Cervix, by any violent Force.

The Cervix is an Apophyſis, ſituated interiorly at the ſuperior Part of the Bone, being inclined ſuperiorly, and a little anterior, and making an Angle with the Body, more or leſs oblique; but in ſome Subjects, it lies almoſt tranſverſly. Towards the inferior Part, it expands, into a kind of Baſis; and at its middle narrow Part, we obſerve a rough ſuperficial Impreſſion, which ſurrounds it like a Collar.

The Trochanter Major is a large Tuberoſity, lying on the exterior, and a little toward the poſterior Part of the Baſis of the Cervix. It is very high, and turned a little poſteriorly, terminating in an obtuſe Point, in which there is a Cavity or Foſſula. Its Convexity is unequal, and diſtinguiſhed into ſeveral Surfaces, which are muſcular Impreſſions; and the like are found on its Margin and concave Side.

The Trochanter Minor lies on the poſterior and inferior Parts of the Baſis of the Cervix, being turned interiorly.

Between the two Trochanters, poſteriorly, there is an oblong, oblique Eminence, which makes a ſort of Communication between them, and lengthens out the Cavity, behind the Trochanter. Anteriorly, there is likewiſe a broad oblique Line, ſometimes conſiderably raiſed, which runs between the two Apophyſes, and terminates the Baſis of the Cervix anteriorly.

The inferior Extremity of the Femur is broader and thicker; being, as it were, the Baſis of the whole Bone. We obſerve in it two large articular Eminences, ſituated laterally with Reſpect to each other, which are ſeperated and very prominent, on the poſterior, but united like a Pulley on the anterior Side. They are called Condyles; and with

with reſpect to the Length of the Body of the Bone, the internal Condyle is longer, and reaches inferior than the other; but Regard being had to the Obliquity of the Bone, there is very little Difference between them, both lying nearly in the ſame horizontal Plane.

The external Condyle is broader, and advances anteriorly than the other.

They are covered with a ſmooth Cartilage, and though they both make but one Body, they are, in ſome meaſure, diſtinguiſhed, on the anterior and inferior Sides, by a ſuperficial Depreſſion, after the manner of a Pulley, and behind, they are parted by a deep round Foſſa.

In this large Foſſa or Sciſſure, there are ſeveral ſmall Foramina; and likewiſe two ſuperficial and pretty broad ſemilunar Impreſſions, one at the inferior Margin of each Condyle; that on the internal Condyle, being ſituated anteriorly, and the other a little poſteriorly.

On the Side of each Condyle, there is a Tuberoſity, and behind that a muſcular Impreſſion, together with a ſmall cartilaginous Surface; on which lies a kind of ſeſamoïd Bone, as we ſhall ſee in deſcribing the Muſcles.

The Body, or middle Portion, of this Bone repreſents a Pillar or Cylinder bent anteriorly.

We may however diſtinguiſh three Sides in it, one anterior, which is more rounded in the middle, than in the ſuperior and inferior Parts; and two poſterior, more flat than the former, and ſeparated by a long angular Ridge, called Linea Aſpera, which is rough, unequal, and very prominent, and ſeems to ariſe from both Trochanters.

On the exterior Side of this Ridge, ſuperiorly, there is a rough longitudinal Mark, a little depreſſed inferiorly at the Extremity. Below, the Linea Aſpera is divided into two, each running in the

Direction of the Condyles; but being ſoon loſt after the Diviſion, a flat triangular Surface, very broad near the Condyles, comes in its Place. The external Line is more prominent than the internal, till they both bend.

There is likewiſe another oblique unequal Line, before and under the Trochanter Minor, which, as it deſcends, unites with the Linea Aſpera. All theſe Lines, Ridges, and Depreſſions, are for the Inſertion of Muſcles; about the middle of the Bone poſteriorly, we ſee ſometimes one Foramen, ſometimes more, for the Paſſage of ſanguineous Veſſels and Nerves.

The natural Direction of the Femur is not perpendicular, but oblique; the ſuperior Extremity being inclined externally, the inferior Extremity interiorly; ſo that the two Bones, as has been already ſaid, are at a greater Diſtance above than below; and from hence we ſee the Reaſon, why the internal Condyle appears to reach lower down than the external, when we view a ſingle Bone.

This Bone is ſpongy at the Extremities, and concave in the Middle; the Cavity being filled with reticular Subſtance, and Portions of Laminæ detached from each Side.

It is articulated above, by Enarthroſis, with the Os Innominatum; its Head being received into the Acetabulum; below, it is connected with the Tibia, by a particular Kind of Ginglymus.

Of the Bones of the Leg.

The Tibia is a long Bone irregularly triangular, and much larger at Top than below. Its Name is taken from the Reſemblance it bears to a kind of Pipe or Flute uſed by the Ancients.

The ſuperior Head, or Extremity, of the Tibia conſiſts of two Condyles, the ſuperior Side of which

is

is flat and divided into two cartilaginous Surfaces, almoſt horizontal, and a little concave; one internal, the other external. Between theſe lies a cartilaginous Tuberoſity, which appears to be double, and has Inequalities both on the anterior and poſterior Part, for the Inſertion of Ligaments. The two Surfaces anſwer to the two Condyles of the Os Femoris.

The Internal is ſomewhat oblong, from the anterior to the ſuperior Part, and a little more depreſſed than the other. The External is rounder, and deſcends a little poſteriorly. The whole Head, taken tranſverſly, is oval, except toward the poſterior Part, where there is a ſuperficial Sciſſure; and the Circumference is very rough.

The external Condyle is more prominent than the internal; and on its inferior Part, a little poſteriorly, there is a ſmall cartilaginous Surface for the Articulation of the Fibula.

On the anterior Part of the Head, there is an unequal Tuberoſity, called the Spine, for the Inſertion of the tendinous Ligament of the Patella.

All that Part of the Head, which lies above the Level of the Spine, is Epiphyſis in Children; and the Spine is originally an Epiphyſis, diſtinct from the other; but it afterwards becomes an Apophyſis of the Head of the Tibia.

The inferior Extremity is neither ſo thick, nor ſo broad as the ſuperior. It may be conſidered as its Baſis, and on its exterior Side there is a longitudinal Depreſſion, broader inferiorly, than ſuperiorly; which receives the Extremity of the Fibula.

On the interior Side of the Baſis, there is an Apophyſis called Malleolus Internus, which deſcends down lower than any other Part, and has poſteriorly a Sulcus for the Paſſage of a Tendon.

The Baſis of the Tibia terminates in a tranſverſe, oblong, cartilaginous, articular Cavity; the

Capacity of which is increaſed interiorly by the Malleolus Internus, the Cartilage being likewiſe continued over that Side of it, which is turned toward the Cavity. Through the Middle of this Cavity, a ſuperficial Eminence runs, by which it is divided into a right and a left Portion.

All the inferior Portion of the Baſis of the Tibia together with the Ankle, is Epiphyſis in Children, and the Marks thereof remain for a long time after the Oſſification is perfected.

The greateſt Breadth or longeſt Diameter of the Baſis of the Tibia does not lie in the ſame Plane with that of the Head, the Ankle lying a little interiorly than the internal Condyle. This Obſervation is of great Conſequence in Fractures and Luxations of this Part.

The Body of the Tibia is in a manner triangular; one external, and one poſterior; and into three Angles, one anterior, called the Criſta of the Tibia, and two poſterior.

The internal Side is the broadeſt of the three, very equal, gently convex, being diſtinguiſhed into three Sides, one internal, and turned a little anteriorly. The external Side is unequally flat, and narrower than the former. The poſterior Side is unequally rounded, and the narroweſt of all. At its ſuperior Part, however, it is of a conſiderable Breadth, and there we obſerve a long, oblique, muſcular Impreſſion, beginning under the Sciſſure in the poſterior Part of the Head, and from thence deſcending internally. Immediately below the Extremity of this Impreſſion, there is another leſs oblique.

The anterior Angle, or Criſta, is accute, prominent about the Middle, and almoſt round at the inferior Part. It might be reckoned a Continuation of the Tuberoſity, or Spine. The internal poſterior Angle is ſomething rounded, the exter-

nal is more acute, except toward the ſuperior Part, where it is more or leſs flatted.

The Subſtance of the Tibia is the ſame with the other long Bones. It is connected above, with the Condyles of the Os Femoris, by an Articulation, which is partly a Ginglymus, for the Extenſion and Flexion of the Leg, and partly an Arthrodia, for the Rotation of the Leg, when bent. This is owing to two intermediate Cartilages, which ſhall be examined in the Deſcription of the freſh Bones.

The Fibula, or Peronæus.

It is a ſmall long Bone, irregularly triangular, lying on the exterior Side of the Tibia, almoſt oppoſite to the external poſterior Angle, but a little poſteriorly.

The ſuperior Extremity is a kind of Tuberoſity, or Head, obliquely flatted by a ſmall cartilaginous Plane, by which it is articulated with the cartilaginous Surface at the inferior Part of the external Condyle of the Tibia. It terminates poſteriorly by a kind of ſhort obtuſe Apex directed ſuperiorly.

The inferior Extremity is broader, flatter, and more oblong than the ſuperior. It is partly a Continuation of its Body, and partly an Epiphyſis in Children, the Marks of which are quite loſt in an advanced Age. It has in a manner three Sides, one rounded like a Tuberoſity, one flat, and the third narrow. When it is placed in the lateral Cavity of the Baſis of the Tibia, it makes the external Ankle, oppoſite to the internal Ankle. In its natural Situation, inclines much inferiorly than the Baſis of the Tibia, and terminates in a Point turned a little poſteriorly.

The

The flat Side is cartilaginous, and turned toward the cartilaginous Side of the internal Ankle, with which, and with the inferior Side of the Basis of the Tibia, it completly forms the Cavity by which the Leg is articulated with the Foot. The narrow Side is turned posteriorly, and near its inferior Part is a small, oblong, unequal Fossula, formerly believed to be for the Passage of a Tendon, in which a small mucilaginous Gland is lodged. The Point by which the Basis of the Fibula ends, has a small smooth Surface immediately below the narrow Side, for the Insertion of an annular Ligament.

The Body of this Bone, is long and small, more or less contorted, and irregularly triangular. Near the two Extremities, it contracts into a kind of Cervix, and a little below the Middle, it is often bent internally, but this Curvature may be chiefly owing to the Method of dressing Children, for we sometimes meet with this Bone very strait. It is distinguished, in an irregular Manner, into three Sides and three Angles, principally towards its inferior Part.

The External is the most considerable: The Semi-superior of it is more or less concave; afterwards it grows round; and, altering its Direction, becomes almost posterior in its Simi-inferior. The posterior Side is more or less convex superiorly; then it grows flat, and, turning in the same Manner as the former, becomes nearly internal toward the inferior Part.

The interior Side has likewise a Turn below its Middle, and becomes anterior, from thence inferiorly; and this Turn is marked by an oblique Line, which descends on this Side from the posterior to the anterior, and divides it into two. These Sides serve partly for Muscles to lie upon, and partly for their Insertions.

The internal Structure of the Fibula, though a very small Bone, is like that of the other long Bones.

Bones. It is articulated by its ſuperior Extremity with the inferior Surface of the external Condyle of the Tibia. This Articulation is an Arthrodia, with a very ſmall Degree of Motion. The inferior Extremity is articulated by its cartilaginous Side, partly with the lateral Depreſſion in the Baſis of rhe Tibia, and partly with the firſt Bones of the Foot, completing the Ginglymus between the Leg and that Bone.

The internal Angle of the Fibula anſwers to the external poſterior Angle of the Tibia; and both ſerve for the Inſertion of the inter-oſſeous Ligament of the Leg; the other two Angles are more or leſs ſharp, eſpecially the anterior, which is ſometimes like a kind of Criſta, and terminates before, in a ſmall triangular Surface.

The Patella, or Rotunda.

It is a ſmall Bone, ſituated above the Spine of the Tibia, ſomewhat reſembling a large Cheſtnut, is about half as thick as long, and its Length and Breadth are nearly equal.

Its Baſis is the ſuperior and thickeſt, where ſeveral tendinous Impreſſions are obſervable, which deſcend a little on the convex Side. The Apex is obtuſe, and ſerves for the Inſertion of a ſtrong Ligament, which ties the Patella to the Spine of the Tibia.

The anterior Side is convex, with ſome ſmall Inequalities and Sulci on it. The poſterior Side is concave, covered with a Cartilage reaching near the Apex, and terminating at an unequal Cavity, or Foſſula, which is an Impreſſion for the Ligament already mentioned.

This cartilaginous Side is parted in two by a Ridge, which goes between the Baſis and Apex; and the two Parts are exactly ſuited to the Pulley of the Femur, being externally broader than in-

ternally, which is likewise observable in the Pulley.

The Patella remains long and cartilaginous; in ossifying, it becomes intirely cellulous, except the Surfaces of its two Sides and the Impressions.

It is connected with the Tuberosity of the Tibia, by a thick strong Ligament, which may be looked upon as particularly belonging to the Tibia, or as a moveable Olecranum, which is as fixed to the Patella.

The Bones of the Foot.

The Foot is the third Portion of the inferior Extremity, and is divided into three Parts, the Tarsus, Metatarsus, and Toes.

The Tarsus consists of seven Bones, much larger than those of the Carpus, the Names of which, in the Order in which they are commonly described.

The particular Division of each of these Bones, and indeed of all the Bones of the Foot, are much more easy than in the Bones of the Hand, because the Foot remains always in the same Attitude; and therefore the anterior, posterior, superior, inferior, lateral, and other Parts, may be certainly fixed, without any Danger of mistaking.

According to the natural Situation of the Foot, and its Connection with the Leg, the Astragalus is the superior and first Bone of it. This Bone may be divided into two Portions, one large and posterior, which is, as it were, its Body; one small and anterior, which is an Apophysis, or the anterior Portion. The Body, or posterior Portion, has four Sides, one superior, two lateral, and one inferior. The superior Side is the largest, covered all over with a Cartilage cylindrically convex, from the anterior, to the posterior, with a Depression running through the Middle of its Breadth, which

which reprefents half a Pulley, and continuous with the two lateral cartilaginous Sides, of which the external is broader than the other. This fuperior Side is articulated with the inferior Side of the Bafis of the Tibia; the internal lateral Side with the inner Ankle; and the external lateral Side with the outer Ankle. Below the internal lateral Side, there is a great Depreffion without Cartilage, and feveral other Inequalities.

Inferiorly likewife it is cartilaginous and obliquely concave for its Articulation with the Os Calcis; at the inferior and pofterior Part of the Body of the Aftragalus, on the Margin of the inferior Side, is a fmall, oblique, fmooth Sciffure, for the Paffage of Tendons.

The Apophyfis, or anterior Part of the Aftragalus, is diftinguifhed from the Body, by a fmall Depreffion fuperiorly; and inferiorly, by a long, oblique, unequal Sciffure, very broad toward the external. The anterior Side of this Apophyfis is all cartilaginous, and obliquely convex, for its Articulation with the Os Scaphoïdes.

The inferior Side, likewife cartilaginous, is parted in two, and articulated with the Os Calcis; being diftinguifhed from the inferior Side of the Body of the Bone, by the long oblique Sciffure already mentioned. Befides thefe two cartilaginous Sides, there is a third below the anterior interiorly, which, in the Skeleton, touches nothing.

The Os Calcis is the largeft Bone of the Foot, which makes the pofterior Part, and in fome meafure the Bafis. It is oblong and very irregular, and may be divided into a Body and two Apophyfes, one great and anterior, the other fmall, lateral, and internal.

The Body of the Os Calcis has fix Sides, one pofterior, one anterior, one inferior, one fuperior, and two lateral.

The

The poſterior Side is broad, unequally convex, and, as it were, divided into two Portions, one ſuperior, ſmall, and poliſhed; the other inferior, much larger, unequal, and rough, which, in Children, is an Epiphyſis; and may be named the Tuberoſity of the Os Clavis: The inferior Part of it is bent inferiorly, and terminates in two Tubercles, or obtuſe Points, which belong rather to its inferior than to its poſterior Side.

The ſuperior Side may be divided into two Parts, one poſterior and unequal, having a ſmall Depreſſion; the other anterior, convex, and cartilaginous, proportioned to the great inferior Cavity of the Aſtragalus anteriorly, and, by this Obliquity, becomes Part of the anterior Side; the remaining Part of which is loſt in the anterior Apophyſis. It is inferiorly narrow, and behind it lie the two Tubercles, already mentioned, of which the internal is the biggeſt. They both ſerve for the Inſertion of the Aponeuroſis in the Sole of the Foot, but chiefly the biggeſt.

The two lateral Sides are continued over the anterior Apophyſis. The external is gently convex and unequal, covered only by the common Integuments, and Ligaments. The internal is concaved and depreſſed.

The great, or anterior Apophyſis, lies in the ſame Direction with the Body, being a Continuation thereof. It has five Sides, or remarkable Parts, and were it not for the Body, it would have a ſixth.

The ſuperior Side has an irregular and unequal Depreſſion, which, together with that in the Apophyſis of the Aſtragalus, forms a conſiderable Foſſula; at its anterior Extremity, there is a ſmall cartilaginous Surface, anſwering to one of thoſe in the Apophyſis of the Aſtragalus. The anterior Side of the Apophyſis is broad, oblique, cartilaginous, partly convex and partly concave, and articu-

articulated with a like Surface of the Os Cuboïdes. This is the fore Side of the whole Os Calcis, when considered without any Division.

The exterior Side of the Apophysis is very rough, being a Continuation of the external Side of the Body, with a Tubercle, or Eminence, at the Place where these two Sides meet, which however is not found in all Subjects. On the inferior Part of this Tubercle, is a cartilaginous Surface for the Passage of the Tendon of the Peronæus Longus. Sometimes we see only some small Vestiges of this Eminence, and often none at all. We sometimes meet with another small, cartilaginous, inferior Surface, which is anteriorly near the anterior Extremity of the Apophysis, for the Passage of the same Tendon.

The inferior Side is a Tuberosity continued from the Side of the Body, and designed for the Insertion of Muscles.

The lateral Apophysis is almost common to the Body, and to the great anterior Apophysis, and increases the Cavity on the Inside of the Os Calcis.

On its superior Part, it has a very smooth cartilaginous Surface, articulated with one of the inferior Surfaces of the Astragalus. This Apophysis is very inferior, and its inferior Part is smooth for the Passage of Tendons.

The Os Scaphoïdes, called also Os Naviculæ, from its Resemblance to a little flat Boat, lies before the Astragalus. It has two cartilaginous Sides, an oval Circumference, and a Tuberosity; its Thickness is inconsiderable, when compared with its other Dimentions, and it lies, as it were, on its Side before the Astragulus.

The concave Side is posterior, and articulated with the anterior convex Side of the Astragulus. The anterior

anterior convex Side is divided, by two ſmall Lines, into three Planes, for the Articulation of the three Oſſa Cuneiformia.

The Circumference forms an Oval, which contracts by ſmall Degrees, and terminates in an obtuſe Point. One Side of this Circumference is more convex and rough than the other, and the Inequalities in it ſerve for the Inſertion of Ligaments.

The Apex of the Oval ends in a Tuberoſity, marked with a muſcular Impreſſion; in the natural Situation of this Bone, the moſt convex Side is ſuperior, the other inferior, and the Tuberoſity interiorly and inferiorly.

By this Situation and the Difference of the Sides, it is eaſy to diſtinguiſh the Os Naviculæ of the right Foot from that of the Left. The ſmall or inferior Convexity of the Circumference has, near the Tuberoſity, a ſuperficial Sciſſure; and on the oppoſite Side, a ſmall cartilaginous Surface and a ſmall Tubercle, for its Articulation with the Os Cuboïdes, and the Inſertion of Ligaments.

The Os Cuboïdes is ſituated before the Os Calcis, on one Side of the Os Scaphoïdes. It is a Maſs with ſix Sides, all very unequal and very irregular; and from theſe it has its Name.

The ſuperior Side is flat and rough, for the Inſertion of the Ligaments, which connect it with the neighbouring Bones.

The inferior Side has an oblique Eminence, and immediately below that a Sulcus, which is likewiſe oblique. The Eminence divides the Sides into two, and is a little cartilaginous on that Margin which touches the Sulcus: This Sciſſure appears to be cartilaginous from a Ligament which lines it, and both that and the Margin of the Eminence ſerve for the Inſertion of an annular Ligament, and for the Paſſage of the Tendon, Peronæus

næus Longus; poſteriorly, it is cartilaginous, broad, oblique, partly convex, and partly concave, anſwering anteriorly to the Os Calcis anteriorly, it is pretty broad, and divided into two Portions, by a narrow prominent Line, by which Portions, this Bone is articulated with the third and fourth Bones of the Metacarpus.

The internal Side is the longeſt of all; it has a ſmall cartilaginous Surface, by which it is articulated with one of the Oſſa Cuneiformia. The reſt is rough with ſeveral Depreſſions, in which Veſſels and Glands are lodged.

Behind the cartilaginous Portion, there is, in ſome Subjects, another narrow Surface, which is articulated with the contiguous Portion of the Circumference of the Os Scaphoïdes; this Articulation, when wanting, is ſupplied by Ligaments.

The external Side is the leaſt of all, irregular, ſhort, and narrow, and it has a Sciſſure, which communicates with the Sulcus on the inferior Side.

The Ossa Cuneiformia are three in Number, ſituated before the Os Scaphoïdes, and they have their Name from the Reſemblance they bear to Wedges; the firſt is the longeſt, the third the largeſt, and the ſecond of a middle Size between the other two. With the Os Cuboïdes, they form a ſort of Arch, which, on the Side next the other Foot, is high; and low on the oppoſite Side.

In each Side we may diſtinguiſh the Baſis, Apex, and four Sides; one poſterior, one anterior, and two lateral; whereof one is internal, the other external.

The firſt Bone is like a Wedge, contorted and bent; its Baſis, which is unequally rounded like an oblong Tuberoſity, ſerving for the Inſertion of a Tendon.

The internal lateral Side, or that which is turned toward the other Foot, is unequally convex,

and rough for the Infertion of Ligaments; the external lateral Side, or that next the fecond Bone, is unequally concave and cartilaginous toward the fuperior and pofterior Margin. The largeft Portion of the Side is articulated with the fecond Bone; the reft toward the anterior Margin is joined laterally to the fecond Bone of the Metatarfus.

The pofterior is the leaft, cartilaginous, and almoft triangular, fituated to the firft of the three triangular Surfaces of the Os Scaphoïdes.

The anterior is cartilaginous, large, and femilunar; the convex Side being turned to the other Foot, and by this the firft Os Cuneiforme is articulated with the firft Bone of the Metatarfus.

The Angle is turned fuperiorly, and the Obliquity thereof occafions the anterior Side to be the higheft, and the pofterior the inferior.

The fecond Os Cuneiforme, the leaft of the three, has the Bafis fuperiorly, and the Angle inferiorly, and refembles a Wedge more than the firft. Its Bafis is fhort and rough for the Infertion of Ligaments; the pofterior Side is cartilaginous and perfectly triangular, fituated to its Articulation, with the middle Surface of the convex Side of the Os Scaphoïdes. The anterior Side is alfo cartilaginous, a little more oblong, and articulated with the Bafis of the fecond metatarfal Bone.

The two lateral Sides, have, toward their fuperior and pofterior Margins, oblong cartilaginous Surfaces, by which they are articulated with the firft and third Offa Cuneiformia. The reft of thefe two Sides is a little depreffed, and thereby fmall Interftices, or void Spaces, are left between the Bones. This is every way the fhorteft Bone of the three. Its Angle is hid between the other two Bones, of the fame Name, and does not reach fo low as theirs, which makes this Part of the Foot a little concave.

The

The third Os Cuneiforme, is of a middle Size, between the other two, has likewise its Basis upward, and its Angle downward. The Basis is longer than that of the second, almost flat, or very little convex, and rough for the Insertion of Ligaments.

The posterior Side is cartilaginous and triangular; that is, of the same Figure with the third Surface of the convex Side of the Os Scaphoïdes. The anterior Side is likewise cartilaginous and triangular, but a little oblong, being articulated with the Basis of the third Bone of the Metatarsus.

The internal lateral Side, is broad with two cartilaginous Surfaces, one toward the posterior Margin, the other toward the anterior. The first is for its lateral Articulation with the second Os Cuneiforme, the second for its Articulation with the Basis of the second metatarsal Bone.

The external lateral Side is likewise broad, and, toward its posterior Margin, has a large cartilaginous Surface for its Articulation with the Os Cuboïdes. Toward its anterior Margin there is a sort of void Space for the Passage of Vessels, and sometimes a little cartilaginous Corner for its lateral Articulation with the fourth Bone of the Metatarsus.

The Metatarsal Bones.

The Metatarsus is composed of five Bones, which, in their general Characters, agree with the metacarpal Bones, but may be distinguished from them, by the following Marks, 1st, They are longer, thicker, and stronger. 2dly, Their anterior round Margins are not so broad, and are less in proportion to their Basis. 3dly, Their Bodies are sharper above, and flatter on the Sides, with their inferior Ridge inclined more externally. 4thly, The Tuber-

cles at the inferior Roots of the round Heads are larger.

The firft, or metatarfal Bone is eafily diftinguifhed from the reft by its Thicknefs. The next to it is longeft, and with its fharp Margin, almoft perpendicular. The others are fhortened more obliquely, as their Situation is more external: Which general Remarks, with the Defcription I am now to give of each, may teach us to diftinguifh what Bone, and to which Foot any one belongs, that can be offered to our Examination.

Os Metatarfi Pollicis is by far the thickeft and ftrongeft, as having much the greateft Weight to fuftain. Its Bafe is oblong, irregularly concave, and of a femilunar Figure, to be adapted to the Os Cuneiforme maximum. The inferior Margin of this Bafe is a little prominent and rough, where the Tendon of the Peronæus primus Mufcle is inferted. Externally, an oblique circular Depreffion is made by the following Bone. Its round Head has generally on its fore Part a middle Ridge, and two oblong Cavities, for the Offa Sefamoïdea; and on the external Side a Depreffion is made by the following Bone.

Os Metatarfi of the fecond Toe is the longeft of the five, with a triangular Bafe fupported by the Os Cuneiforme Medium, and the external Side produced into a Procefs, whofe Extremity is an oblique fmooth Plane, to be connected to the Os Cuneiforme externum.

Near the internal Margin of the Bafe, this Bone has two fmall Depreffions, made by the Os Cuneiforme maximum, between which is a rough Cavity. Farther forwards, we may obferve a fmooth Protuberance, which is joined to the foregoing Bone.

On its external Bafis are two oblong fmooth Surfaces for its Articulation with the following Bone;

Bone; the ſuperior ſmooth Surface being extended longitudinally, and the inferior perpendicularly; between which there is a rough Foſſa.

Os Metatarſi of the middle Toe is the ſecond in Length. Its Baſis, ſupported by the Os Cuneiforme externum, is triangular, but ſlanting externally, where it terminates in a ſharp pointed little Proceſs; and the inferior Angle is not completed.

The internal Side of this Baſis is adapted to the preceding Bone, and the external Side has alſo two ſmooth Surfaces, covered with Cartilages, but of a different Figure; for the ſuperior is concave and poſteriorly round, and the little inferior ſmooth Surface is convex, and very near the Margin of its Baſis.

Os Metatarſi of the fourth Toe is near as long as the former, with a triangular ſlanting Baſe, connected to the Os Cuboïdes, is very large, tuberous, and produced into a long pointed Proceſs externally; whence Part of the Abductor minimi Digiti has its Origin; and ſuperiorly the Peronæus ſecundus is inſerted. Its Inſide has a flat conoïdal Surface, where it is contiguous to the preceding Bone.

The fifth Metatarſal Bone is ſomewhat rough at its Baſis and is tranſverſly broader, than it is thick or high, being very oblique, and terminating by a Tuberoſity and Point, which lies at a great Diſtance from the Plane of its Baſis. The Tuberoſity is externally, and the Margin quite poſteriorly. The principal Side is oblique, anſwering to that of the Portion of the anterior articular Side of the Os Cuboïdes.

There is likewiſe an internal lateral Surface, articulated with the Baſis of the fourth Bone, the poſterior Part of the Bone expanded proportionably to the Baſis, ſo that this Bone is obliquely

 pyramidal;

pyramidal; and the Tuberofity reaches the Ground, in the natural Situation of the Foot.

When we ftand, the anterior Ends of thefe metatarfal Bones and the Os Calcis are our only Supporters, and therefore it is neceffary they fhould be ftrong, and have fuch a confined Motion as they have.

The Bones of the Toes are much akin to thofe of the Thumb and Fingers; particularly the two of the great Toe are precifely formed as the two laft of the Thumb; only their Pofition, in refpect of the other Toes, is not oblique, and they are proportionally much ftronger, becaufe they are fubject to a greater Force; for on thofe, principally, the Weight of the Body is fupported, when we are raifed on our Tip-Toes.

The three Bones, in each of the other four Toes, differ from thofe of the Fingers, in thefe Particulars. They are lefs, and fmaller in Proportion to their Length: Their Bafes are much larger than their anterior Ends: Their Bodies are fharper above and below, and flatter on the Sides.

The firft Phalanx is proportionally much longer than the Bones of the Second and Third, which are very fhort.

Of the Four, the Toe next to the great one, has the largeft Bones in all Dimenfions, and more externally the Toes are lefs. The little Toe, and frequently that next to it, have the fecond and third Bones, intimately united into one, which may be owing to their little Motion, and the great Preffure they are fubjected to.

The Toes are very ufeful to us in Walking; for when the Sole is raifed, they bring our Body, with its Center of Gravity perpendicular to the advanced Foot.

The

The Bones of the Metatarſus and Toes are in the ſame Condition in Children, as thoſe of the Metacarpus and Fingers.

The only Bones now remaining to complete the Deſcription of the Skeleton, are the ſmall ones, which are found at the Joints of the Fingers and Toes, and in ſome other Parts, called Oſſa Seſamoïdea, which are very different Figures and Sizes, though they are generally ſaid to reſemble the Seed of the Seſamum.

They ſeem to me nothing elſe than the Ligaments of the Articulations, or the firm Tendons of ſtrong Muſcles, or both become oſſeous; by the violent Compreſſion which they ſuffer. Thus the ſeſamoïd Bones at the Beginning of the Gaſtrocnemii Muſcles are evidently compoſed of the tendinous Fibres only.

Theſe, at the firſt Joint of the Great Toe, are as plainly the ſame continued Subſtance, with the Ligaments and Tendons of the Abductor, Flexor brevis, and Adductor.

That, which is ſometimes double at the ſecond Joint of the Toe, is Part of the circular Ligament; and if we enumerate the other ſeſamoïd Bones, that are at any Time found, we may obſerve all of them formed in the ſame Manner. Their Number, Figure, Situation, and Magnitude, are ſo uncertain that it were in vain to inſiſt on the Differences of each: 1ſt, That whenever the Tendons and Ligament are firmeſt, the Actions of the Muſcles ſtrongeſt, and Compreſſion greateſt, there ſuch Bones will be moſt probably found. 2dly, That, cæteris paribus, the older the Subject is in which they are ſought, their Number will be greater, and their Size bigger. 3dly, The more Labour in either, or both Extremities, that any Perſon is inured to, he will, cæteris paribus, have the moſt numerous and largeſt Oſſa Seſamoïdea.

However, as the two, at the first Joint of the great Toe, are much larger than any other, and are seldom wanting in an Adult, we may judge, that, besides the more forcible Course of their Formation, there should also be some particular Advantage necessary at this Place, rather than elsewhere, which may possibly be allowed to the Flexor Muscles, to send their Tendons along this Joint, secure from Compressions in the Hollow between the two oblong Sesamoïd Bones; while, by removing these Tendons from the Center of Motion, and giving them the Advantage of the Angle at their Insertion, the Force of Muscles is increased, and therefore the great super-incumbent Weight of our Body, in Progression, is more easily raised. MONROE's Anatomy of the Bones.

LEC-

LECTURE XII.

The CARTILAGES and LIGAMENTS of the SUPERIOR EXTREMITY.

NO Part of the Os Femoris is covered with Cartilage, except the uniform Convexity of its Head and the articular Portion of the uniform Extremity. The Trochanters have no true Cartilage, what looks like it being only the Remains of tendinous Inſertions, as has been obſerved already of the Criſta of the Os Ilium. The cartilaginous Subſtance, which, to a certain Age, unites the Epiphyſes to the Body of the Bone, does not belong to this Place, becauſe it is only formed in time of Youth, and in Adults is converted into Bone.

The cartilaginous Subſtance, by which the Head of the Os Femur is cemented, deſerves, however, to be obſerved, becauſe that Epiphyſis has been ſeparated by violent Falls.

The Convexity of that Head, all the way to its Symphyſis with the Cervix, is covered by a very ſmooth ſhining Cartilage. We have already remarked in the Oſteography, that a little below the Convexity, and ſomething toward the poſterior Part, there is a Depreſſion in the Form of a Creſcent; the Cartilage being there interrupted by the Inſer-

tion

tion of the articular Ligament of the Head of the Femur.

The Cartilage which covers the inferior Extremity of this Bone, is exactly fitted to the semi-oval Convexity of the inferior Surface of each Condyle, and to the Trochlea formed by their Union.

In the posterior Part of the lateral Tuberosity of each Condyle, there is another kind of cartilaginous Surface.

Ligaments of the Os Femoris.

The Femur is connected by its superior Extremity to the Ilium, and by the inferior, to the Bones of the Leg, by means of several Ligaments. The Ligaments of the superior Extremity are two; One, which surrounds the whole Articulation thereof, with the cotyloïd Cavity, and one contained in the Articulation.

The first is termed the orbicular Ligament of the Head of the Femur; the other, the internal Ligament. To these we may (though very improperly) add a Third, which is of the Nature of a capsular Ligament, as we shall describe.

The orbicular Ligament is the most considerable, largest, and strongest of all the articular Ligaments of the human Body. It is fixed quite round the Margin of the cotyloïd Cavity; and from thence largely surround the whole Head, and superior Portion of the Cervix of the Femur, and is closely inserted inferiorly to the Cervix, that is, between its Basis, and middle narrow Part.

This Ligament is composed of several sorts of Fibres; the chief of which are longitudinal and oblique, and it is much thicker and stronger in some Parts than in others. It is very thick between the anterior inferior Spine of the Ilium, all the

the way to the ſmall anterior Tuberoſity, which unites, as it were, the Baſis of the Trochanter major with the Baſis of the Cervix.

It is likewiſe very thick, between the ſame Spine, and the Middle of the oblique Linea Aſpera, obſervable between the Tuberoſity and the minor Trochanter; and here likewiſe it is ſtrengthened by a Bundle of Fibres, connected to the Paſſage of the Tendon of the Iliac Muſcle, and to the inferior Portion of the oblique Linea Aſpera. The Diſpoſition of the ligamentary Fibres, of which theſe two thick Portions are compoſed, form a ſort of Triangle, with the oblique rough Line, which terminates the Baſis of the Cervix.

At the poſterior and ſuperior Part of this Ligament, there is another thick Portion formed by oblique Fibres, one End of which is fixed between the inferior Margin of the cotyloïd Cavity, and the Paſſage of the Tendon of the external obturator Muſcle; the other to the ſuperior Part of the ſmall Tuberoſity of the Trochanter major, already mentioned.

The poſterior and inferior Parts of it are thinner and ſhorter than the reſt; but even this is ſtrengthened by a Faſciculus of pretty ſtrong Fibres, which, from the whole Criſta of the Pubis, decends obliquely anteriorly, near the cotyloïd Sciſſure, and is fixed ſuperiorly to the Baſis of the Cervix of the Femur, immediately above the ſmall anterior Tuberoſity of the Trochanter major.

The other Ligament of the Head of the Os Femoris, which Winslow names internal, reſembles a flat Cord, being compoſed of a Bundle of Fibres compactly interwoven. One End of it is in a manner divided into two flat Membranes, inſerted, one at each Corner of the cotyloïd Sciſſure, in the manner already explained. It might likewiſe

wife be called the inter-articular Ligament of the Head of the Os Femoris.

From this Infertion, it defcends obliquely, and a little afcends, between the cotyloïd Gland, and the cartilaginous Convexity of the Head of the Femur, and terminates fuperiorly to the fmall femi-lunar Foffula, which may be reckoned the Pole of that Convexity. This Infertion is obliquely, a little rounded fuperiorly, and flat inferiorly, and, in fome Subjects, there is a fort of Depreffion in the Head of the Bone for the Paffage of the Ligament.

The Ligaments of the inferior Extremity of the Femur, by which this Bone is connected with thofe of the Leg, are fix in Number, one pofterior, two lateral, two middle or crucial, and one capfular.

The crucial Ligaments lie within the Articulation, and are fixed by one Extremity to the Sciffure, or Opening, which parts the two Condyles; they are furrounded by the capfular Ligament, but all the reft lie externally thereof, being clofely joined to it.

Of the two lateral Ligaments, one is internal and broad, being fixed to the Tuberofity of the internal Condyle. The other is external and narrow, fixed to the Tuberofity of the external Condyle.

The pofterior Ligament is broad and thin, being fixed a little above the Convexity of the external Condyle, from whence it defcends obliquely behind the great Sciffure, and internal Condyle.

The capfular Ligament, glued, as it were, to the three former, as has been faid, is fixed quite round the inferior Extremity of the Femur, at a fmall Diftance above the anterior, lateral, and pofterior Parts of the Cartilage, and above the pofterior of the great Sciffure, through the fmall Space fuperiorly, already mentioned, it covers the Bone; and afterwards is inverted inferiorly to form the Capfula,

for

for the mucilaginous Liquor of the Articulation. The reſt of the Deſcription of all theſe Ligaments, muſt be referred to that of the Bones of the Leg.

The Marrow of the Femur lies in a large Maſs, in the middle Cavity of the Bone, and in ſmall diſtinct Cluſters, in the Cells of each Extremity. The firſt is penetrated at different Diſtances, by the oſſeous Filaments, or Ramifications of the reticular Texture, and thereby ſuſtained in violent Motions and Shocks, as in Leaping, Running, &c.

Cartilages of the Bones of the Leg.

The Tibia has four or five proper Cartilages, and two Additionals.

The two proper Cartilages, which cover the two ſuperior Surfaces of the Head of the Tibia, are the thickeſt. They are both a little convexive, but the internal, or that next the other Tibia, is more depreſſed in the Middle than the other. The poſterior Part of the external is inſenſibly depreſſed, and thereby a Sort of Convixity is formed. Anteriorly, they connect each other, poſteriorly; they are parted by a ſlight Sciſſure; in the Middle they are ſeparated by the articular Tuberoſity of the Head of the Tibia, which is likewiſe partly covered by them on each Side.

The third proper Cartilage covers the ſmall Surface, which lies on the inferior Part of the external Condyle.

The fourth covers the inferior Surface of the Baſis of the Tibia, being continued over externally of the internal Ankle.

There are likewiſe ſuperficial cartilaginous Incruſtations, poſteriorly, of this Baſis behind the internal Ankle, and likewiſe on the poſterior of the external Ankle, all for the Paſſage of Tendons.

The

The additional Cartilages of the Tibia, are two in Number called Semi-lunar from their Figure, and inter-mediate, or inter-articular from their Situation.

Each of theſe Cartilages is in the Figure of a Creſent, or Roman C. Their Convexity, or greateſt Curvature is very thick; their Concavity, or ſmalleſt Curvature, very thin, ſomething like the Edge of a Sickle. They lie on the two ſuperior Surfaces of the Head of the Tibia; their thickeſt Part, or Convexity, anſwering to the Margins of the Head, and their thin acute, to the Middle of each Surface, their Extremities, or Cornua, being turned toward each other.

Each Cartilage is ſufficiently broad to cover about two Thirds of the Surface of the Tibia, on which it lies, leaving one Third bare in the Middle. Their under Sides are flat; the ſuperior Sides concave, and, together with the middle Portions of the Surfaces of the Head of the Tibia, form Cavities proportionable to the Convexty of the Condyles of the Femur.

The Fibula has two Cartilages; one lying on the ſuperior Extremity of that Bone, for its Articulation with the ſmall cartilaginous Surface in the Head of the Tibia. The other Cartilage lines the Inſide of the inferior Extremity, or of the external Malleolus; near the Point of which, poſteriorly, there is a ſuperficial cartilaginous Incruſtation, for the Paſſage of the Tendons of the Muſculi Peronæi. The Cartilage, at the ſuperior Extremity of the Fibula, ſeems to be thicker than that at the inferior Extremity.

The Patella, which belongs properly to the Tibia, and not to the Os Femoris, has a pretty thick Cartilage on its poſterior or articular Side, divided, by a ſuperficial longitudinal Riſing, into two Parts, proportioned to the two Portions of the Trochlea

of

of the Femur, as has been obſervéd in the Deſcription of the Bones.

Ligaments of the Bones of the Leg.

I have obſerved, that the Tibia is connected with the Os Femoris, by ſeveral Ligaments; two lateral, one poſterior, two middle, and one capſular; and I have ſhewn in what manner they are fixed in the inferior Extremity of the Os Femoris: Their Inſertions in the Bones are as follow.

The interior and broadeſt of the two lateral Ligaments is fixed ſomewhat inferiorly on the internal Surface of the ſuperior Part of the Tibia, between the Beginning of the Criſta, or anterior Angle, which is turned toward the other Tibia. It is likewiſe connected to the Margin of the internal Semi-lunar or inter-articular Cartilage.

The external lateral Ligament, which is narrow and thicker than the former, is fixed partly in the Tibia, immediately above the Fibula, and partly in the ſuperior Extremity of the Fibula; and connected likewiſe to the Margin of the external ſemi-lunar Cartilage. Both theſe Ligaments lie a little behind the Middle of the Articulation.

The poſterior Ligament is fixed by ſeveral Expanſions, in the poſterior Part of the Head of the Tibia.

One of the crucial Ligaments is fixed by one End to the internal ſuperficial Impreſſion in the Sciſſure of the Os Femoris; and by the other, to the Sciſſure in the Head of the Tibia, behind the cartilaginous Tubercle, which lies between the two ſuperior Surfaces.

The other crucial Ligament is fixed by one Extremity to the external Impreſſion in the Sciſſure of the Femur; and by the other, between the anterior

terior Portions of the Surfaces juſt mentioned, before the cartilaginous Tubercle.

Theſe two Ligaments are compoſed of ſeveral Series of Fibres. The firſt (which is internal in reſpect to the Femur, and poſterior in reſpect of the Tibia) is broader and ſtronger than the other, which is external in regard of the Os Femoris, and anterior to the Tibia.

The Semi-lunar Cartilages have likewiſe particular Ligaments, beſides their Connexions with the lateral Ligaments of the Tibia. Their Cornua, in ſome meaſure, degenerate into ſhort ſtrong Ligaments, by which they are faſtened to the cartilaginous Tubercle, between the two ſuperior Surfaces of the Tibia, and likewiſe communicate, by ſome Portions, with the crucial Ligaments.

They have likewiſe a common Ligament, which, like an Arch, runs tranſverſly between the anterior Convexity of the one to that of the other.

Theſe Cartilages, therefore, have three Sorts of Connexions. They are fixed to the Tibia, by the Ligaments of the Cornua; to each other, by the tranſverſe Ligament; and to the Femur, by their Communications with the crucial Ligaments; and by their Adheſions, to the lateral and capſular Ligaments. The Patella is faſtened to the Tuberoſity or Spine of the Tibia, by a broad and very ſtrong Ligament, which deſcends directly from the Apex of the Patella, and is oftentimes ſtrengthened by ſome Fibres of a conſiderable Tendon, inſerted in the ſuperior Part of that Bone.

It has likewiſe ſmall lateral Ligaments fixed in the inferior Part of its Margin on each Side, which parting gradually from the great Ligament as they deſcend, are inſerted anteriorly, and a little laterally in the Margin of the Head of the Tibia.

The capſular Ligament of this Articulation, of which I deſcribed one Part in ſpeaking of the inferior

inferior Extremity of the Femur, is fixed round the Margin of the Head of the Tibia, and in the Margin of the Patella; ſo that the Patella itſelf forms a Portion of the mucilaginous Capſula of the Joint of the Knee.

The crucial Ligaments, and thoſe of the ſemilunar Cartilages, are included within the Capſula; but the lateral and poſterior Ligaments, and thoſe of the Patella, lie without it, being cloſely connected to its external Surface.

This Capſula is likewiſe connected to a conſiderable Portion of the Circumference of the Semilunar Cartilages, and it is alſo corroborated at different Diſtances, by ſeveral diſtinct Series of ligamentary Fibres, more or leſs thick. The Inſide of it is ſmooth; and ſhining and very thin, where it is not covered by Tendons, as ſhall be obſerved hereafter. It not only contains and ſurrounds the Ligaments already named, but likewiſe furniſhes them with a very fine Vagina.

There is likewiſe a very thin Ligament, fixed by one Extremity to the inferior cartilaginous Side of the Patella; and by the other, to the anterior Part of the great Sciſſure, between the Condyles of the Femur; the Uſe of which ſeems to be to prevent the articular Fat from being compreſſed in the Motions of the Knee.

The Fibula is connected to the Tibia, by nine Ligaments; four at each Extremity, and one in the middle, called the inter-oſſeous Ligament.

The Ligaments at the ſuperior Extremity of the Fibula, are ſhort, very ſtrong, more or leſs oblique, and compound. Two of them are anterior, two poſterior, and they lie on each other; the ſuperior Ligaments ſurrounding the Articulation more cloſely than the inferior, which leave a ſmall void Space, and are weaker than the former. They are all coagulated to the capſular Ligament, which

 runs

runs in between them and the Articulation; and they are inserted round the Margin of the cartilaginous Surfaces in each Bone.

The Ligaments of the inferior Extremity of the Fibula, which run below the Tibia, and form the external Malleolus, are much stronger, thicker, more complex, broader, longer, and more oblique, than those of the superior Extremity; and are disposed much after the same Manner; that is, two before, and two behind.

They are fixed to the anterior and posterior Margins of the lateral Depression, at the inferior Extremity of the Tibia; and from thence they descend on the inferior Extremity of the Fibula. The two inferior Ligaments are largest, and fixed anteriorly and posteriorly at the inferior Extremity of the external Malleolus. The two superior are fixed more compactly and nearer each other, but there still remains a small Space between them, filled with Fat.

As the two Bones touch each other only by the superior Part of the cartilaginous Surface of the external Malleolus, and the small cartilaginous Borders in the inferior Margin of the Depression of the Tibia, the middle Space between them is filled by a sort of capsular Ligament, which lines each Side of the Bones, and is continued down to the true Articulation of the external Malleolus, with the inferior Margin of the Basis of the Tibia.

The middle or inter-osseous Ligament of the two Bones of the Leg, so called, from its Situation between them, being stretched from one to the other, is fixed along the posterior external Angle of the Tibia and the adjacent Angle of the Fibula.

At the inferior Part of each Ankle, there are commonly three strong Ligaments for the Connexion of the Bones of the Tarsus with those of the

Leg;

Leg; one that advances, one that deſcends poſteriorly, and one that runs more or leſs directly inferiorly; all of them being fixed in the Places, which ſhall be deſcribed.

There are ſome other ligamentary Expanſions belonging to the Bones of the Leg; but as they do not ſerve ſo much for the Connexion of the Bones, as to ſupport the Muſcles, the Deſcription of them, as well as the annular Ligaments, will more naturally come in, in the Treatiſe of the Muſcles.

Marrow and mucilaginous Glands of the Bones of the Leg.

The Marrow of theſe Bones lies in large Maſſes in the great Cavities, and in diſtinct Moleculæ in the ſpongy Parts, as has been already obſerved in general.

The mucilaginous Glands lie in the ſmall Spaces, Depreſſions, and ſuperficial Sciſſures near the Margins of the Cartilages of each Joint. They are covered by the capſular Ligaments, and more or leſs mixed with a fatty Subſtance.

The Glands of the Knee, which lie near the Margins of the Patella, are the moſt conſiderable, being diſpoſed in form of Fringes, and ſupported by a great Quantity of fatty Matter, which makes, in ſome meaſure, one Maſs with them.

This common Maſs is contained within the capſular Ligament, and on the Side of the Joint is covered by a very fine Membrane, which likewiſe lines the interior Surface of the Ligament. The glandulous Subſtance is eaſily diſtinguiſhed from the Foot, by the reddiſh Colour of the capillary Veſſels, which ſurrounds them.

The ſuperior Portion of this Maſs, is, as it were, ſuſpended by the ſmall Ligament, fixed anteriorly of the great common Sciſſure of the Condyles of

 the

the Femur; and which from thence aſcends ſuperiorly to the Patella, as has been already obſerved in the Deſcription of the Ligaments.

There are other mucilaginous Glands, both above and below, the Margin of the ſemi-lunar Cartilages.

And likewiſe in the Femur, ſome whereof ſerve for the Articulation of the reſt, for the crucial Ligaments. Theſe laſt lie in Folds, formed by the internal Membrane of the capſular Ligament, which give particular Coverings to the circular Ligaments, and to the other Faſciculi of the ligamentary Fibres near them.

Cartilages of the Bones of the Foot.

The Aſtragalus is covered by three Cartilages: The firſt covers the three Surfaces, which makes the Convexity and Sides of the Trochlea; the ſecond, the concave Surface of its anterior Part, ſo far as to form three other ſmall Surfaces, one of which is not articular in a ſtrict Senſe.

The firſt of theſe Cartilages is for the Articulation of this Bone with the Tibia and Fibula; the Second, for the Os Calcis; and the Third, for the Os Scaphoïdes.

Two of the inferior Surfaces, formed by the Continuation of the third Cartilage, are for the Articulation of this Bone, with the Os Calcis; the Third contributes to the Formation of a Canal for the Paſſage of a Tendon.

The Os Calcis has four Cartilages; of which three are ſuperior, one large, and two ſmall; for its triple Articulation with the Aſtragalus; the fourth is anterior, for the Os Cuboïdes. To theſe muſt be added, a ſmall thin Cartilage, of a kind of ligamentary Subſtance, under the Tubercle, on the external Side of this Bone.

The

The Os Scaphoïdes, has two remarkable Cartilages: One poſterior, for its Articulation with the Os Calcis; and one anterior, lying in two Planes, for its Articulation with the two laſt laſt metacarpal Bones. It has likewiſe a Cartilage on the Inſide for the Os Cuneiforme, which is next to it, and one inferiorly, covering a Part of the oblique Eminence ſituated there.

The three Oſſa Cuneiformia have each of them a poſterior Cartilage, for their Articulation with the Os Scaphoïdes; and one anterior, for the three firſt metatarſal Bones. They have likewiſe ſmall cartilaginous Surfaces on their lateral Sides, for their Articulations with each other; and beſides, the firſt and third Bones are connected thereby to the lateral Parts of the Baſis of the ſecond metatarſal Bone; and the third, to the Os Cuboïdes.

The Baſes and Heads of the metatarſal Bones are covered with Cartilages.

The Phalanges have Cartilages in the ſame manner at their Baſes and Heads, except at the Heads or Extremities of the laſt.

The ſeſamoïd Bones are covered with Cartilages on that Side, by which they ſlide on other Bones.

We ought to beware of confounding the Remains of Tendons, Ligaments, and Aponeuroſes, with the true Cartilages; as for Inſtance, at the poſterior Part of the Os Calcis; I gave the ſame Caution when I ſpoke of the Cartilages in general.

Ligaments of the Bones of the Foot.

The Foot, being compoſed of ſeveral Bones, muſt, beſides thoſe Ligaments, by which it is tied to the Leg, have ſeveral others to connect, not only the three Parts of which it is compoſed, but alſo

the particular Bones belonging to each Part. We have already mentioned the Insertions of three Ligameants in each Ankle.

The Ligaments of the internal Malleolus, are all fixed in the Inside of the Astragalus. The most anterior is pretty broad, and sometime seems to be connected in one, with the middle Ligament. It often consists of several distinct Parts, like so many Membranes interlarded with Fat.

The anterior and middle Ligaments, of the external Malleolus, being more or less broad, are fixed exteriorly, to the Astragalus; the posterior, which is narrowest, and pretty thick, is chiefly fixed in the external of the great Portion of the Os Calcis.

All these Ligaments lie externally on the Surface of the Capsula, which surrounds the Articulation of the Astragalus with the Bones of the Leg.

The Ligaments, by which the Bones of the Tarsus are connected with each other, are short, flat, of different Breadths, and run from one Bone to another in various Directions. They are all superficial, except one, by which the Astragalus is tied to the Os Calcis, and for the most Part, are either superior or inferior, the lateral Ligaments being but very few in Number.

Some of them are partly common to several Bones, and partly belong only to two; the superficial Strata of their Fibres, run over one Bone into the following, and sometimes further; but the Strata next the Articulation, are generally confined to two Bones only.

The Astragalus is tied to the other Bones of the Tarsus, by several true Ligaments, viz.

To the Inside of the Os Calcis, by a Ligament, which comes from the posterior internal Tuberosity of the Body of the Astragalus, and is fixed in

in an Inequality behind the lateral Apophyſis of the Os Calcis.

To the interior Surface of the ſame Bone, by a Ligament, which comes from the lateral Apophyſis of the Os Calcis, and is fixed in a ſort of cartilaginous Production internally to the Cervix of the Aſtragalus.

To the external Surface of the ſame Bone, by two Ligaments, which form the Margin of the oblique inferior Depreſſion of the Aſtragalus, and afterwards ſeparating a little, are fixed in the external Surface of the great Apophyſis of the Os Calcis; one anteriorly, which ſeems to ſend off a ſmall Portion to the Os Cuboïdes, the other poſteriorly of different Breadths.

To the Os Scaphoïdes ſuperiorly, by a Ligament which goes from the Cervix of the Aſtragalus to the ſuperior Part of the Os Scaphoïdes, and from thence is extended to the Middle of the Os Cuneiforme.

To the ſame Bone interiorly, by two Ligaments, one of which is a Continuation, of that which goes from the lateral Apophyſis of the Os Calcis, to the cartilaginous Production of the Aſtragalus; the other is near the ſame Production, being partly covered by the former, and fixed in the Tuberoſity of the Os Scaphoïdes.

To the Os Calcis, by a Ligament which comes from the oblique inferior Depreſſion of the Aſtragalus, and is fixed in the oblique ſuperior Depreſſion of the Os Calcis.

If to theſe principal Ligaments of the Aſtragalus, we add ſeveral leſs remarkable, and alſo thoſe by which it is tied to the Ankles, their Numbers will be very conſiderable.

The capſular Ligaments go very little further than the Margins of the Articulations of this Bone with the reſt. They adhere very cloſely to the

the true Ligaments, and are covered and lined by them.

The Os Calcis is joined to the external Malleolus and Aſtragalus by the Ligaments already deſcribed. It is likewiſe connected to the Oſſa Scaphoïdes and Cuboïdes by ſeveral ligamentary Planes. It is connected to the Os Scaphoïdes, 1ſt, by a Continuation of the Ligament that goes from its lateral or internal Apophyſis to the cartilaginous Production of the Aſtragalus. 2dly, By a ligamentary Lamina, which goes from the inferior Tuberoſity of its great Tuberoſity of its great Apophyſis, and is fixed in the inferior Part of the Circumference of the Os Scaphoïdes. 3dly; By a narrow Ligament which goes from the ſuperior and internal Part of the ſame Apophyſis, and ends in the neareſt Part of the Circumference of the Os Scaphoïdes.

It is connected to the Os Cuboïdes, firſt, by a Ligament, or rather by ſeveral ligamentary Faſciculi, which go from the Extremity of its oblique ſuperior Depreſſion to the contiguous Angle of the Os Cuboïdes. Secondly, by one lying between the firſt, and the ſmall external lateral Tuberoſity of the Os Calcis, and inſerted in the Os Cuboïdes near the firſt. Thirdly, by one which is fixed to the exterior and inferior Part of the great Apophyſis of the Os Calcis, and to the contiguous Part of the Os Cuboïdes. Fourthly, by a pretty broad Lamina, which covers the inferior Part of the Os Calcis; and which, from the anterior Tuberoſity of this Part, ſpreads over the contiguous inferior Part of the Os Cuboïdes, and terminates in the oblique Eminence of that Bone. Fifthly, by a broader Lamina, which, having filled the inferior Part of the lateral Concavity of the Os Calcis, is chiefly inſerted in the contiguous Angle of the Os Cuboïdes.

The

The capſular Ligaments agree with thoſe of the Aſtragalus.

The Os Scaphoïdes is tied to the Aſtragalus and Os Calcis in the Manner already ſaid.

It is likewiſe connected to the Os Cuboïdes, and the Oſſa Cuneiformia, by ſeveral Ligaments on the external Surface, or that next the Os Cuboïdes; there is one which connects it to the contiguous Angle of that Bone. On its ſuperior Part, two go from its Circumference, one to the ſecond, the other to the third Cuneiforme. On its anterior Side, it is joined to the convex Side of the great Os Cuneiforme by two Ligaments. On its lower Side it has four; whereof the firſt appears as if it were double, going from the Tuberoſity of this to the Baſis of the firſt Os Cuneiforme; the ſecond and third go obliquely to the other two Oſſa Cuneiformia; the fourth is a little tranſverſe, being fixed in the inferior internal Angle of the Os Cuboïdes.

The Os Cuboïdes, beſides the Ligaments which tie it to the Aſtragalus, Os Calcis, and Os Scaphoïdes, already mentioned, has others which connect it above, below, and on the external Side, with the third Os Cuneiforme, and two laſt Bones of the Metatarſus. The ſuperior Ligaments are almoſt equally flat, the inferior unequally thick, and ſtronger than the ſuperior. The exterior goes from the Os Cuboïdes to the Tuberoſity in the Baſis of the laſt Bone of the Metatarſus, and ſeems likewiſe to communicate with the third Bone by ſome ligamentary Fibres.

The three Oſſa Cuneiformia are fixed to the Os Scaphoïdes, by the Ligaments abovementioned. They are connected ſuperiorly by particular ligamentary Laminæ, which go more or leſs tranſverſly from one Bone to another; being all joined to one common ligamentary Lamina, which covers

covers these three Bones, and also the Os Cuboïdes. Inferiorly, they are connected by stronger and thicker Ligaments. They are likewise connected by Ligaments to the three first Bones of the Metatarsus.

The greatest Os Cuneiforme is joined on its superior, inferior, and interior or convex Side to the Basis of the first metatarsal Bone, by ligamentary Fibres, which form almost a continued Lamina; the inferior Part of which is strong and thick, and appears to be double. It is likewise tied interiorly to the Basis of the second metatarsal Bone, by a particular Ligament.

It has likewise exteriorly, on its inferior Part, three considerable Ligaments, more or less oblique; the first and shortest of which goes to the Basis of the second metatarsal Bone, the second to that of the third, and the third to that of the fourth.

The Bones of the Metatarsus are connected by their Bases and Heads. The Ligaments that go between the Bases are superior and inferior. The superior are flat and small; the inferior strong and thick, and, as it were, multiplied by entering the Interstices between the Bases.

The Ligaments, which go between the Heads, have nearly the same Disposition. The inferior have this peculiar to them, that by filling the Spaces between the Heads, they keep them at some Distance from each other. The inferior Portions of these Ligaments are fixed in the Angles, at the lower Part of each Head. They are moreover corroberated by their Union and Intertexture with the Aponeurosis Plantaris.

The first Phalanges of the Toes are tied to the Heads of the metatarsal Bones, by a Sort of orbicular Ligament, set round the Margins of the cartilaginous

cartilaginous Portions of the Head, and thoſe of the Baſes of the Phalanges.

In the four Toes, next the great Toe, the inferior Part of theſe Ligaments is very thick, and cruſted over, as it were, with a cartilaginous Subſtance, fixed to the Baſis of the Phalanges, and from thence continued over the Head of the metatarſal Bone next it. This Subſtance grows hard with Age, like a ſeſamoïd Bone.

Of theſe Seſamoïds, the great Toe has two belonging to the firſt Phalanx; which are the largeſt, the firſt formed, and moſt conſiderable of all that go by that Name. They are ſhaped like an Olive, being about one third Part of an Inch in Length, and about half as broad as long.

They are connected by their anterior Extremities to the Baſis of this Phalanx, cloſe by each other, and lie in the two Depreſſions inferiorly, to the Head of the firſt metatarſal Bone.

The ſecond and third Phalanges of all the Toes, being articulated by the Ginglymi, have lateral Ligaments, which go between the Sides of the Heads; at the inferior Margins of all theſe Baſes, there is a cartilaginous Matter, connected to the Ligaments, which hardens with Age, in the ſame Manner as thoſe of the firſt Phalanges.

The capſular Ligaments of all theſe Articulations are diſpoſed in the ſame Manner as in the firſt Bones of the Tarſus already deſcribed.

The annular Ligaments and ligamentary Vaginæ found on the Surface of many of theſe Bones, contribute nothing to their Connection, and therefore ſhall be explained in another Place.

The Perioſtium, which covers all theſe Bones, is of the ſame Kind with that of the Bones of the Leg.

The Marrow is ſuitable to their internal Structure, that is in Moleculæ, in the cavernous Portions,

tions, and in Masses; in those which have large Cavities. Thus the Marrow of all the tarsal Bones is disposed in Moleculæ, because their internal Structure is spongy. In the metatarsal Bones, and first Phalanges of the Toes, it is disposed in the same Manner, as in the Tibia and the Fibula; that is, it lies in Moleculæ, in the Extremities; the Structure of which is cavernous, but in the middle Portions of them, it lies in Masses, greater, or less, according to the Size of the Cavities.

In the other Phalanges which are entirely spongy, it is accordingly disposed in Moleculæ.

The mucilaginous Glands answer, in Number and Figure, to the Depressions between the cartilaginous Margins and Ligaments.

Mechanism and Use of all the Bones of the Inferior Extremities.

The Articulation of the Os Femoris with the Os Innominatum, being by Enarthrosis, that is, the spherical Head of the Thigh-Bone, being lodged in the Acetabulum, the Thigh is disposed to be moved on all Directions. We can carry it forward and backward, nearer the other Thigh, or to a greater Distance from it; and these four Motions may be rendered more or less oblique, and thus the Number of them may be multiplied, according to the different Degrees of Obliquity.

All these Motions may likewise be combined in such a Manner, as that the inferior Extremity of the Bone shall describe a sort of Circumference, while the Head moves round a Center.

The

The Os Femoris may alſo have another kind of Motion; called by Anatomiſts Rotation; though very improperly. By this Motion, they underſtand two reciprocal half Turns that are, in oppoſite Direction to each other; which the Thigh is capable of making round an Axis; but it is very evident, if we conſider the Obliquity of the Cervix, that this Motion is not round the Axis of the Bone, but round a Line from the Head, to the Middle of the Pulley at the lower Extremity, when the Subject is ſuppoſed to be ſtanding.

We are likewiſe to obſerve, that by this Rotation of the Os Femoris, the Cervix and great Trochanter are moved ſimply poſteriorly and anteriorly; whereas, when the Bone is moved directly forward or backward, the Cervix moves more or leſs round its Axis; eſpecially if, at the ſame time, the Bone be held at ſome Diſtance from the other.

All the Motions of the Os Femoris are differently limited by the Structure of its Articulation; and eſpecially by that of the Acetabulum: And likewiſe pretty much by the Situation of the Head on the ſuperior Extremity of the Bone. In a word, the Depth and Obliquity of this Articulation render the Mechaniſm thereof very particular; and it is of the greateſt Conſequence to be well acquainted with it, in Caſes of Luxations and Fractures.

The following Obſervations will be ſufficient to give a true Idea of it.

The Thigh ought to ſupport firmly the Weight of the whole Body, when we ſtand or kneel; and that in all the different Attitudes, or Changes of Situation, that is, whether the Trunk be ſtrait, inclined, or turned, and even with the Addition of a conſiderable Load.

The Thigh is moveable in all Directions, but the Motion of Flexion is the greateſt of all, whether we ſtand, or ſit, that of Adduction is likewiſe con-

conſiderable; eſpecially when the Thigh is bent. Theſe two Motions are more frequent, as well as of a greater Extent, than the reſt; for it is chiefly by them that the Body is carried from one Place to another, and alſo put in ſeveral ordinary and neceſſary Situations, whether ſtanding, ſitting, or lying.

Theſe two general Diſpoſitions are founded on the Depth and Obliquity of the Articulation. By the firſt, the Thigh becomes able to ſupport the Body in all the Attitudes already mentioned; and by the ſecond, the principal Motions are made eaſy.

The Acetabulum, or cotyloïd Cavity is deeper on the ſuperior and back Part, than on the inferior and fore Part: And it is at theſe two Places, or in the middle Space between them, that the Body is ſuſtained, according as it is in an erect or inclined Poſture. The Structure of the Head of the Os Femoris is exactly ſuited to theſe ſupporting Points in the Acetabulum; its cartilaginous Convexity being larger on the upper Part, than any where elſe. The Acetabulum is ſhallow on the fore and lower Parts, not only becauſe theſe Parts are leſs neceſſary for ſupporting the Body, but alſo becauſe a Proviſion is thus made for the Bones of the Obliquity of the Articulation; without which, the Thigh could not, without great Difficulty, have been bent, or carried inwards, or over the other Thigh. The Obliquity of the cotyloïd Cavity facilitates the Motion of the Adduction: and the Obliquity of the Head of the Os Femoris facilitates and inlarges the Motion of Flexion.

In the Motion of Adduction, Part of the Head of the Bone goes out of the Cavity; and that in two different ways. When we ſtand, or lie at full Length, and, in thoſe Poſtures, ſeparate the Thighs from each other, the Head goes out at the lower

Part of the Cavity; but when we ſit, or lie on our Backs, with the Thighs raiſed and ſeparated, it goes out on the fore Part.

The Motion, called Rotation, varies according as the Thigh is extended, or bent. The Rotation of the Thigh, when extended, brings the Head of the Os Femoris, either forward or backward; when the Head is carried backward, the Neck ſtrikes againſt the poſterior Margin of the Acetabulum, and a large Portion of the Head goes out at the anterior Part of the Cavity; but when the Head is carried forward, a very ſmall Portion of it goes out of the Cavity, becauſe of the Depth of the Margin at the back Part: And the Cervix does not ſtrike againſt the anterior Margin, which is very low. In the Rotation of the Thigh, when bent, the Head is brought upwards and downwards, and goes leſs out of the Cavity above, than below.

The Articulation of the Tibia with the Os Femoris, is of a very ſingular Nature. For the Flexion and Extenſion of the Tibia, it is a Ginglymus; but there is ſomething more in it ſtill, by which the Leg becomes capable of having a Rotation, independent of that of the Thigh. This double Mechaniſm depends on the ſemilunar Cartilages; and therefore muſt be referred to the Deſcription of the freſh Bones. It will be ſufficient, in this Place, to make that Motion be conceived; which I term the Rotation of the Leg, when bent; becauſe in that Caſe only, it is poſſible; and we ſee it evidently, when ſitting and preſſing the Heel againſt the Ground, we turn the Toes alternately outward and inward.

We then obſerve, that the whole Leg makes reciprocal half Turns independently of the Thigh; and if, at the ſame Time, we put our Hand upon the Knee, and then graſp the Joint with onr Fingers,

gers, we feel the Head of the Tibia to move, in the ſame Manner; while the Extremity of the Os Femoris remains at reſt.

And if we examine attentively, we ſhall find that the Center of this Motion is rather in the inner Cavity of the Head of the Tibia, than in the middle Space between the two Cavities, for we feel diſtinctly, that the external Part of the Head of the Tibia moves backward and forward, while the internal turns almoſt wholly round its Axis; we may therefore diſtinguiſh three Sorts of Motion in this Joint; that of Flexion and Extention, the Rotation of the internal Part of the Head of the Tibia upon an Axis, and a kind of Arthrodial Motion of the external Part of the ſame Head.

I look upon the Patella, as a Piece belonging as really and particularly to the Tibia, as the Olecranium does to the Ulna; becauſe it is of the ſame Uſes, with reſpect to that Bone, as the Olecranium is to the other. They both ſerve to facilitate the Action of the extenſor Muſcles, by placing their Direction at a greater Diſtance from the Center of Motion of the Joint.

They both ſerve to defend the Tendons of theſe Muſcles from the Compreſſions, Contuſions, and Ruptures, which they would otherwiſe be ſubject to in great Efforts, did they paſs over the ſharp Margins of the Bones; and laſtly, they ſecure theſe Tendons from the like Accidents, when the Joints ſtrike againſt, or preſs upon, any hard Body; as when we lean on the Elbow, or kneel, or when the Elbow or Knee receive any external Injury from Blows.

The Difference between the Patella and Olecranium lies in this; that none is immoveable, making but one Piece with the Ulna. The other is immoveable, being a Piece diſtinct from the Tibia. The Immobility of the Olecranium ſtrengthens and

and secures the Articulation of the Ulna with the Os Humeri, which is designed only for Flexion and Extension.

For the same reason the Patella would have been immoveable, had the Articulation of the Tibia with the Os Femoris been contrived for these two Motions alone, and especially because the extensor Muscles of the Tibia are very often exposed to greater Efforts, in supporting the Weight of almost the whole Body; sometimes increased by that of a considerable Burden.

The Rotation of the Leg, when bent; is the sole Cause of this Difference, because, had the Patella been immoveably joined to the Tibia, the Leg could never have made these half Turns, without either a Luxation or Fracture of the Patella. The Olecranum may therefore be looked upon as an immoveable Patella, and the Patella as a moveable Olecranum.

The Fibula is articulated by its superior Extreemity with the inferior Surface of the external Condyl- of the Head of the Tibia. This is an obscure Arthrodia, and suffers the Head of the Fibula only to slide a little anteriorly and posteriorly; the only Design in which small Degree of Motion seems to be that the Fibula, in which many Muscles of the Foot are inserted, may have liberty to yield a little in the violent Efforts of these Muscles; as in running much, jumping, or walking under a heavy Burden, as we shall see in the Exposition of the Muscles.

This Bone is likewise joined to the Tibia, by its inferior Extremity, and makes the outer Ankle: But this Connexion is chiefly ligamentary, as has been shewn in the Discription of the fresh Bones. The superior Margin of the cartilaginous Surface of this Extremity is articulated at the lower Part of the lateral Depression of the Tibia with a narrow car-

laginous Border, which is nothing but the thick Margin of the Cartilage at the Basis of that Bone.

The Extremities of these two Bones touch each other likewise a little by their osseous Portions, near the Cartilages. The Articulation, resulting from these two sorts of Connexion, has but a very small Extent, and seems to be partly a Synarthrosis, partly a Diarthrosis; that is a sort of Amphiarthrosis or double Articulation, almost without any Motion, except when it is necessary to make the center of Motion, of the superior Extremity of the Fibula. The cartilaginous Side of the external Ankle, or lower Extremity of the Fibula, completes the Cavity; by which the Leg is joined to the Foot, and contributes more to that than the internal Ankle.

The Crookedness frequently observed in the Fibula below the Middle, or at about two Thirds of its Length, does not seem to be natural; (because we sometimes meet with this Bone, perfectly strait) but to be rather owing to the Manner of depressing Children, this being the Place, at which they are swaddled very tight.

The Fibula is not situated directly on the Outside of the Tibia, but a little more backward; so that having placed the two Legs of a Skeleton in their natural erect Posture, a pretty thick Body might be passed between the two Tibiæ and Fibula without changing the Situation of the Legs.

The Foot is Articulated with the Leg by the Astragalus alone. This Articulation is a true angular Ginglymus, and confined intirely to the Motions of Flexion and Extension.

It is commonly thought, that two other Motions are likewise performed by means of this Articulation, viz. that of turning the Toes inward or outward, and that of the lateral Flexion of the Foot, or the turning the Sole of the Foot toward either

either Ankle, but neither of these Motions depend on the Articulation of the Foot, with the Leg; as the Structure of the Parts and just Observations evidently shew.

The Articulation of the Astragalus with the several Surfaces of the Os Calcis, is a kind of obscure Arthrodia as well as those of the other Bones of the Tarsus with each other. By these Articulations, the Foot not being supported, makes the small lateral Motions already mentioned: But when the Toes are turned outward or inward independent of the Tibia. The Os Calcis makes small semi Rotations under the Astragalus, and obliges the Os Scaphoïdes to slide in the same Direction with it on the anterior Side of the Astragalus, and this Motion of these two Bones is communicated to all the rest.

It is by the Articulation of the Os Scaphoïdes with the Astragalus, that the small lateral Flexions of the Foot are performed, viz. when the Sole of one Foot is turned toward the other Foot, or the contrary way: In this Case, the Os Scaphoïdes makes small Rotations on the anterior Side of the Astragalus, while the Os Cuboïdes slides up and down on the fore Side of the great Apophysis of the Os Calcis. The Obliquity of the articular Surfaces of these two Bones, is perfectly suitable to such a Motion, in these Motions the Os Calcis and Astragalus, are in a manner immoveable; but the other Bones are carried along with the Os Scaphoïdes.

The Articulation of the Os Scaphoïdes and Cuboïdes with the Ossa Cuneiformia, that of the four last mentioned Bones with those of the Metatarsus, and that of the metatarsal Bones with each other, allow of an obscure Motion; by which we can bend or contract the Foot according to its

Length, and a little according to its Breadth likewiſe.

All theſe Motions of the Bones of the Tarſus and Metatarſus, are pretty ſenſible in Children; and the Loſs of them is often owing to the Manner of wearing Shoes; which Loſs is moſt frequent in the ſmall Bones of the Tarſus, and thoſe of the Metatarſus. Women's high heel'd Shoes change intirely the natural State of thoſe Bones; cauſing in them the ſame ſort of Diſorder that we obſerve in the Vertebræ of crooked Perſons. Thoſe who do not wear ſtrait Shoes, may preſerve theſe Motions to a very advanced Age.

The Articulation of the firſt Phalanges of the Toes with thoſe of the Metatarſus is ſpheroïdal or orbicular, and allows Motion in different Directions. The Articulation of the Phalanges, with each other, is by a Ginglymus: In the natural State, theſe Motions are very free and eaſy, and they are impaired chiefly by the bad Manner of wearing Shoes, and it is for the ſame Reaſon that the Phalanges of the little Toe often grow together. The Articulation of the ſeſamoïd Bones is a kind of Ginglymus, but the Explication thereof belongs to the Hiſtory of the Muſcles.

LECTURE XIII.

SARCOGRAPHY.

Of the TEGUMENTS.

ALL the Parts of the human Body are invested by several common and universal Coverings, which Anatomists name Teguments.

There have been many Disputes about the Number of the Integuments. The Ancients reckoned five, viz. The Epidermis, Cutis, Membrana Adiposa, Panniculus Carnosus, and Membrana Musculorum Communis.

The first three of these Coverings are truly common or universal; that is, extended over all Parts of the Body; but, properly speaking, they ought to be reduced to two, for if we consider the Epidermis is rather a Part of an Epiphysis of the Skin, than a Tegument.

The two other Coverings mentioned by the Ancients are not universal, but confined to particular Parts of the Body.

The Cutis, or Skin, is a Substance of very large Extent, formed of several kinds of tendinous, membranous, reticular, and nervous Fibres, the Intertexture of which is so much the more won-

derful, as it is difficult to unfold; for their Direections are as various as those of the Stuff of which a Hat consists*.

This Texture is what we commonly call Leather, and makes, as it were, the Body of the Skin. It is not easily torn, may be elongated in all Directions, afterwards recovers itself, as we see in fat Persons, in Women with Child, and Swellings; and it is thicker and more compact in some Places than in others.

Its Thickness and Compactness are not, however, always proportionable; for on the posterior Parts of the Body, it is thicker and more lax than the anterior Parts; and on the Palms of the Hands, and Soles of the Feet, it is both very thick and very solid. It is generally more difficult to be pierced by pointed Instruments in the Belly, than in the Back.

The external Surface of this Substance is furnished with small Eminencies, which Anatomists have thought fit to call *Papillæ*, in which the capillary Filaments of the cutaneous Nerves terminate by small radiated Pencils.

* Anno 1657. In nosocomio nostro, præsentibus viris celeberrimis, Dom. JOANNE VAN HORNE, & Dom. FRANCISCO SYLVIO, medicinæ professoribus in illustri academiâ Lugduno batavâ, necnon Dom. GULIELMO PISONE, & Dom. FRANCISCO VANDER SCHAGEN, practicis Amstelodamensibus, vidimus juvenem quendam Hispanum, annorum 23; cujus nomen GEORGIUS ALBES, qui manu sinistrâ apprehendebat cutem humeri, mammæque dextræ, eamque ita extendebat, ut ori esset proxima; menti cutem utrâque manu primò ducebat deorsum, instar barbæ, ad pectus ipsum, hinc sursum attollebat ad capitis verticem, sic ut oculum utrumque ea tegeret. Quamprimùm removebat manum, cutis contrahebatur adeò, ut debitam lævitatem reciperet; ad eundem modum deorsum etiam ducebat cutem genû dextri, sursumve, ad ulnæ dimidiæ longitudinem, & hæc in locum naturalem facilè iterum reducebat. Consideratione dignum erat, cutem eam quæ dictis locis, partes sinistras extendi nullo modo potuisse, firmissimè iis adhærentes. Causam cognoscere hactenus non licuit. JOBI à MEECKREN, Observat. Medico-Chirurgicæ. Cap. XXXII.

These

These Papillæ differ very much in Figure and Difpofition, in the different Parts of the Body, and they may be diftinguifhed into feveral Kinds.

The greateft Part of them is flat, of different Breadths, and feparated by Sulci, which form a kind of irregular Lozenges. The pyramidal Figure afcribed to them is not natural, and appears only when they are contracted by Cold, by Difeafes, by boiling or by fome other artificial Preparation which alters their ordinary Structure.

The Papilla of the Palm of the Hand, of the Sole of the Foot, and the Fingers and Toes, are higher than on the other Parts of the Body; but they are likewife fmaller, clofely united together, and placed as it were endways, with refpect to each other, in particular Rows, which reprefent on the Skin all kinds of Lines, ftreight, crooked, waving, fpiral, &c: Thefe feveral Lines are often diftinctly vifible in thofe Parts of the Palms of the Hand, which are next the firft Phalanges of the Fingers.

The red Part of the Lips is made up of the Papillæ, reprefenting very fine Hairs, or Villi clofely united together.

There is another particular Kind under the Nails; the Papillæ being there more pointed, or in a manner, conical, and turned obliquely towards the Ends of the Fingers. Thofe which are found in the hairy Scalp, Scrotum, &c. are ftill of the other Sorts.

The Papilla of the firft and fecond Kinds appear to be furrounded at their Bafes, by a foft mucilaginous and pretty vifcid Subftance, which fills the Interftices between them, and reprefents a kind of reticular Texture, the Foramina of which furround each Papilla. This Subftance is commonly called Corpus Reticulare or Mucofum.

The Origin of this reticular, or mucous Body, has not hitherto been ſufficiently explained, and it has not been determined, whether it forms an univerſal Integument, or whether it belongs more properly to the Skin, than to the Papillæ and Epidermis. This Mucous, coagulated and condenſed by Air, and by Preſſure after, being perforated with a Number of exhaling and inhaling Ducts, the Orifices of which are connected together by the interpoſed condenſed Glue: Whether or no, we are not perſuaded to this Opinion, by the mucous Expanſion, upon the Membrane of Tympanum? To which add, the Diſſolution of it in Water, obſerved by moſt eminent Anatomiſts; (which Experiment is by others denied in the Cuticula of Blacks.)

In Inflammations, we obſerve a reticular Texture of capillary Veſſels, more or leſs extended on the Surface of the Skin; and curious Anatomiſts demonſtrate the ſame thing, by fine Injections, which may be looked upon as artificial Inflammations. But neither of theſe Methods proves that in the natural State; theſe Veſſels are ſanguineous, that is, they contain the red globulus Blood.*

It is more probable that this vaſcular Texture is only a Continuation or Production of the very ſmall Capillaries of the Arteries and Veins, which, in the natural State, tranſmit only the ſerous Part of the Blood, while the red Part continues its

* De Chriſto ipſo, narrat Divus Lucas, quòd "cùm eſſet in æſtu "contentius orans, ſudore manebat ſimili ſanguineis guttis ad terram "delabentibus". Cap. XXII.

Hoc vulgò ita accipitur, utſi ipſo ſanguine ſudâſſet Servator mundi: id autem non dicitur; erat ſolummodo ſudor ὡσεί θρόμβοι αἵματος, ſicut ſanguinis guttæ; hoc eſt, guttæ ſudoris adeò magnæ erant, craſſæ, ac viſcidæ, ut inſtar guttarum ſanguinis caderint terram. Ita verba hæc intellexerunt JUSTINUS MARTYR, THEOPHYLACTUS, & EUTHYMIUS. Obſervavit tamen GALENUS, contingere interdum, poros e: multo aut fervido ſpiritu, uſque adeò dilatari, ut etiam exeat ſanguinis per eos, fiatque ſudor ſanguineus. Vid. Lib. de Utilitate Reſpiratione, MEADEI Medica Sacra.

Courſe

Courſe through wider Ramifications, which more properly retain the Name of Blood-veſſels.

This vaſcular Texture is of various Forms and Figures in the different Parts of the Body. It is not the ſame in the Face, with what it is elſewhere, neither is it alike on all the Parts of the Face, as may be diſcovered by the moſt ordinary Microſcopes: And from hence we might perhaps be enabled to give a Reaſon, why one Part of the Body turns red more eaſily than another.

The interior Surface of the Skin is covered by very ſmall Tubercles called commonly cutaneous Glands, and they are likewiſe termed Glandulæ Milares, becauſe of ſome Reſemblance which they are ſuppoſed to bear to Millen-ſeeds.

Theſe Tubercles are partly fixed in a ſmall Foſſula, in the Subſtance of the Skin, which anſwer to the ſame Number of ſmall Cavities in the corpus Adipoſum. Their excretory Ducts open on the external Surface of the Skin, ſometimes in the Papillæ, and ſometimes in one Side of them, as may be ſeen in the Ends of the Fingers, even without a Microſcope.

The greateſt Part of them furniſhes Sweat, and others, a fatty, oily Matter of different Thickneſſes, as in the hairy Scalp; in the Back, behind the Ears, and at the lower Part of the Noſe where this Matter may be ſqueezed out, in form of ſmall Worms. On the Head, this is called the Dandriff, and Filth or Naſtineſs of the other Parts of the Body.

By macerating the Skin in Water, or in any other proper Liquor, theſe Corpuſcles become more viſible, eſpecially in the Skin of the lower Part of the Noſe, and of the Axilla. The late M. DUVERNAY demonſtrated to the royal Academy, that the Structure of ſome of theſe cutaneous Glands reſemble the Circumvolutions of ſmall Inteſtines,

teſtines, perfectly ſtored with capillary Veſſels. The illuſtrious M. MORGAGNI Profeſſor at *Padua* has given the Name of Glandulæ Sebaceæ, to thoſe which furniſh the unctuous Matter above mentioned.

Beſides theſe Corpuſcles, there are other ſmall ſolid Bodies, almoſt of an oval Figure contained in the Subſtance of the Skin. Theſe are the Roots or Bulbs, from whence the Hairs ariſe, and ſome of them are ſituated within the interior Surface of the Skin.

The Skin has ſeveral conſiderable Openings, ſome of which have particular Names; ſuch as the Fiſſure of the Palpebræ, the Nare, the Mouth, the external Foramen of the Ears, the Anus and Apertures of the Parts of Generation.

Beſides theſe, it is perforated by an infinite Number of ſmall Holes called Pores, which are of two Kinds. Some are more or leſs perceivable by the naked Eye: Such as the Orifices of the milky Ducts of the Mamma, the Orifices of the excretory Canals of the cutaneous Glands, and the Paſſages of the Hairs*.

The other Pores are imperceptible to the naked Eye, but viſible through a Microſcope; and their Exiſtence is likewiſe proved by the cutaneous Tranſ-

* LEEUWENHOECK, and others, ſay the Cuticula is ſcaly, and compute that a grain of Sand, of the hundredth part of an Inch Diamiter, will cover two hundred of theſe Scales, and that each Scale has about five hundred Apertures, or Pores; ſo that a grain of Sand will cover 125000 Pores through which we perſpire.

Theſe Pores are Emunctory of the redundonices of the Blood, and by means of Perſpiration.

Theſe Pores or the Extremities of the Arteries, which in cutaneous Diſorders, pour out a ſharp acid Lymphæ, which if it remains long under the Epidermis, cauſe a continual Itching and Corrod; the Cutis as we ſee, in thoſe who had the ſmall Pox.

Therefore the beſt Method that I have found in thoſe, who were very full of Pimples in the ſmall Pox, of the confluent Sort, is to let out the Matter as it gathers under the Epidermis.

piration,

piration, and by the Effects of topical Applications: And from these two Phænomena, they have been divided into arterial and venal Pores.

We ought likewise to observe the Adhesions and Folds of the Skin. It is every where united to the Corpus Adiposum, as shall be said hereafter: But it adheres to it much more closely in some Parts, than in others, as in the Palm of the Hand, Sole of the Foot, Elbow, and Knee.

Some Plica, or Folds in the Skin, depend on the Structure of the Membrana Adiposa or Cellularis as those in the Neck and Nates; others do not depend on that Membrane, such as the Rugæ in Fore-head Palpebra, which are formed by cutaneous Muscles, and disposed more or less in a contrary Direction to these Muscles. These Folds increase with Age.

There is besides a particular kind of Folds in the Skin of the Elbow, Knee, and Condyles of the Fingers and Toes, which are owing neither to the Conformation of the Membrana Adiposa, nor to any Muscle.

Lastly, there is a kind of Plica, or rather Lines, which cross the Lines of the Hand, Sole of the Foot, and corresponding Sides of the Fingers and Toes in different Directions. These serve for Employment to Fortune-tellers.

The Cuticula, or Epidermis.

The exterior Side of the Skin is covered by a thin transparent Web, closely joined to it, which is called Epidermis Cuticula, or the Scarf-skin.

The Substance of the Cuticula appears to be very uniform on the Side next the Skin, and to be composed, on the other Side, of a great Number of very fine squammous Laminæ, without any Ap-

 pearance

pearance of a fibrous or vafcular Texture,* except fome fmall Filaments by which it is connected to the Papillæ, and which perhaps are detached from thence.

This Subftance is very folid and compact, but yet capable of being extended and thickened, as we fee by fteeping it in Water, and by the Blifters raifed on the Skin by Veficatories, or any other Means; and from thence it fhould feem, that it is of a fpongy Texture. It yields very much in Swellings, but not fo much as the Skin, without breaking or cracking.

The Origin of the Epidermis is as obfcure, as its Regeneration is evident, fudden, and furprifing; for let it be diftorted ever fo often, it ftill grows again. It probably rifes from a Subftance that tranfudes from the Papillæ, and therefore the Ancients were in the right to call it an Efflorefence of the Skin.

We muft not however imagine, that it is the Air dries this mucilaginous Matter, and gives it the Form of the Epidermis; becaufe it is found equally in the Fœtus, which fwims continually in Water; and it grows ever in the Palate, when it has been deftroyed by too hot Food; and under Plafters applied to any Part of the Body.

Hard and reiterated Frictions loofen it infenfibly, and prefently afterward, a new Stratum arifes, which thrufts the firft outward, and may itfelf be loofened, and thruft outward, by a third Stratum, and fo on.

It is nearly in the fame Manner, that Callofities formed on the Feet, Hands, and Knees; and the feveral Laminæ or Strata obfervable at the fame

* Ruysch, with all his fine Injections, he nor others never injected it.

time,

time, on many other Parts of the Body are owing to the ſame Cauſe, though many Anatomiſts have looked upon them to be natural. It muſt be acknowledged, however, that on the Palms of the Hands, and Soles of the Feet, the Epidermis is commonly thicker than on any other Part.

The Epidermis adheres very cloſely to the cutaneous Papillæ, from which it may be ſeparated by boiling; or which is a better way, by ſteeping for a long time in Water. It is not impoſſible to ſeparate it with the Knife, but this Management teaches us nothing of its Structure.

It adheres ſtill cloſer to the Corpus Reticulare, which is eaſily raiſed along with it; and they ſeem to be true Portions or Continuations of each other.

It is generally believed, that the Colour of the Epidermis is naturally white; and that the apparent Colour thereof is owing to that of the Corpus Mucoſum. But when we examine ſeparately the Epidermis of Negroes, we find no other Whiteneſs in it, than in a thin tranſparent Lamina of black Horn.

The Epidermis covers the Skin through its whole Extent, except at the Places where the Nails lie. It is marked with the ſame Furrows and Lozenges as the Skin, and has the ſame Openings and Pores; and though it may be ſaid to paſs the Bounds of the Skin, where it is continued inward, through the greateſt Openings, yet at theſe Places it loſes the Name of Epidermis.

When we examine narrowly the ſmall Pores or Holes, through which the Sweat paſſes, the Epidermis ſeems to enter theſe, in order to complete the extraordinary Tubes of the cutaneous Glands. The Foſſulæ of the Hairs have likewiſe the ſame Productions of the Epidermis, and it ſeems to give a ſort of Coat or Bark to the Hairs themſelves.

Laſtly,

Laſtly, the almoſt imperceptible Ducts of the cutaneous Pores are lined by it.

Having macerated the Skin for a long while in Water, the Epidermis, with all its Elongations, may be ſeparated from it, and in that Caſe theſe Productions carry along with them the Hairs, the Bulbs, and even the axillary Glands.

By this Obſervation, we may explain how Bliſters may remain for along time on the Skin, without giving Paſſage through theſe Pores, to the Matter which they contain, which Pores ought to be increaſed, one would think, by this Dilatation and Extenſion of the Epidermis.

For when the Epidermis is ſeparated from the Skin, it carries along with it ſome Parts of the cutaneous Fibres, which being compreſſed by the Matter contained in the Bliſter, ſhut the Pores of ſeparated Epidermis like ſo many Valves; and it is probably theſe ſmall Portions have been taken for Valves of the cutaneous Tubes*.

Uses of the Skin.

It is chiefly and properly the filamentary Subſtance, called the Body of the Skin, which is the

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* Ruysch has ſeparated the Cuticulæ from the Cutis of a Negroe, and found it to be White, as in Europeans; but the exterior Superficies of the ſeparated Part of the Cuticula was blackiſh; and its interior Surface, where the Corpus Reticulare came in View, of a deep Black. It is evident, from this, that the Seat of the Blackneſs in the Skins of theſe People, is neither in the Cuticula nor Cutis, but in the Cutis Reticulare, vid. Adverſor, Anat. Littre has made the ſame Experiment, but it did not prove ſo.

Santorini, obſerves the ſame, He ſays that the Colour of the Skins of the Europeans, is owing to that of lhe Bile; that it is yellow in the Jaundice, black in its laſt Stages, and of a deadiſh white in the Chloroſis, becauſe the Bils itſelf is of theſe ſeveral Colours in theſe Diſeaſes, Vid. Obſervat. Anat.

See alſo, l'Hiſtorie de l'Acad. des Sciences, 1702. & Memoires de Trevoux, 1738.

universal

universal Integument of the Body, and the Basis of all the other cutaneous Parts, each of which has its particular Uses.

The Skin is able to resist external Injuries to a certain Degree, and such Impressions, Frictions, Strokes, &c. to which the human Body is often liable, as would hurt, wound, and disorder the Parts of which it is composed, if they were not defended by the Skin.

The Papillæ are the Organs of Feeling, and contribute to an universal Evacuation, called insensible Transpiration. They likewise serve to transmit from without, inwards, the subtle Particles or Impressions of some Things applied to the Skin. The first of these three Uses depends on the Extremities of the Nerves, the second on the arterial Productions, and the third on the Productions on the Veins.

The cutaneous Glands secrete an oily Humour of different Consistencies, and they are likewise the Origin of Sweat. But without the Epidermis, both Papillæ and Glands would be disturbed in their Functions, on which great Disorders must ensue.

In order to explain the Mechanism of Feeling, or the Touch; we should first be made acquainted with the Senses in general, for which this is not a proper Place; and therefore all that I shall observe here, is, that there are at least two sorts of Feeling, one Particular, the other General.

Particular Feeling is accompanied with a certain determinate Impression, by which we are enabled to discern Objects in a very different Manner, and this is properly what is called the Touch; the proper Organ of which is at the Inside of the Ends of the Fingers. General Feeling is indeterminate and indistinct, not being accompanied with the Impression as the former.

These

Theſe Differences, in the Senſe of Feeling, depend on thoſe of the Papilla; which, in effect, appear to be more cloſe, and made up of a greater Number of Filaments at the Ends of the Fingers than any where elſe; for the nervous Filaments that go to the Fingers, are proportionally longer than thoſe that go to any other Part of the Body.

The Epidermis ſerves to keep the Pencils, or nervous Filaments of the Papillæ, in an even Situation, and without Confuſion; and it likewiſe moderates the Impreſſions of external Objects. Particular, as well as general, Feeling is more or leſs perfect, in proportion to the Thickneſs of the Epidermis, Calloſities, in which, have been ſome times ſeen to deſtroy both.

Another Uſe of the Epidermis is to regulate the cutaneous Evacuations already mentioned; the moſt conſiderable of which is inſenſible Tranſpiration. By this we underſtand a fine Exhalation, or a kind of ſubtle Smoke, which flows out of the Body imperceptibly, and in different Quantities. It might be cutaneous Tranſpiration, to diſtinguiſh it from a pulmonary one.

This cutaneous Exhalation becomes ſenſible by applying the End of the Finger, or Palm of the Hand to the Surface of a Looking-glaſs, or of any other poliſhed Body; for it preſently looks dull, and appears to be covered with a condenſed Vapour. It ſeems to me, that the convex Sides of the Hand and Fingers, furniſh ſo great a Quantity of this Exhalation, as the Palm of the Hand and the Inſides of the Fingers; eſpecially the Extremities which point out the Uſe of this Tranſpiration, viz. to cup the nervous Filaments in due Order for particular Feeling*.

We

* The Proof of inſenſible Tranſpiration is the famous Experiment of SANCTORIUS, continued for thirty Years without Interruption, by which

We may render this Tranſpiration viſible to the Diſtance of about half a Foot from the Body; if we look at the Shadow of the bare Head againſt a white Wall, in a bright Sun-ſhiny Day, and in the Summer Seaſon, we ſhall perceive very diſtinctly, the Shadow of a flying Smoke, ariſing out of the Head, and aſſcending, though we cannot ſee the Smoke itſelf. We may try the ſame Experiment with Dog or Fowl.

It is much in the ſame Manner, that the inviſible Exhalations from burning Charcoal throw a very different Shadow; and that the inviſible Smoke of a Chafing-diſh, Warming-pan, Stove, &c. make all diſtant Objects appear trembling, when viewed on either Side of thoſe Utenſils.

The inviſible cutaneous Evacuation is performed ſimply, and without any Artifice, through the ſmall Pores already mentioned, much in the ſame Manner as we obſerve the Smoke to ariſe from the Intrails of an Animal newly killed and opened. It is a particular and continual Diſcharge of the Serum of the Blood, through the capillary Veſſels of the Skin.

It is naturally very moderate, and it is more abundant in the Summer, before a good Fire, after ſtrong Exerciſe, and during the Diſtribution of the Chyle; than in the Winter, in cold Places, during Inaction, and before Meals.

The tranſpired Matter appears to be in ſome Degree ſaline, as may be obſerved, by applying the

which he found this Evacuation in one Day, was equal to all the ſenſible Evacuations for fifteen Days.

This Calculation is not agreeable to what has been made in other Countries, particularly thoſe from the like Experiments made by DORDAL and MORIN, of the royal Academy of Sciences, and by Dr. JAMES KEIL. Neither can the Balance inform us, whether the cutaneous Tranſpiration is greater or leſs than the Pulmonary ones.

Tongue to the Palm of the Hand, when it has not been lately washed before. This is perhaps the Reason, why we feel less Pain when a Wound is touched with the Finger covered with Silk, than with the naked Finger; but this Inconveniency might easily be prevented by washing the Hands and Fingers very well, immediately before we begin to dress Wounds. The Matter of the other two cutaneous Evacuations, the Sweat and thick oily Substance comes chiefly from the Glands of the Skin. Each of them differ according to the different Parts of the Body where they are found, as may be observed of the Filth and Sweat of the Head, Arm-pits, Hands, Feet, &c.

This Filth or Nastiness of the Skin, is an unctuous or fatty Matter collected insensibly from the Epidermis, where it thickens and forms a sort of Varnish, which in Time becomes prejudicial, by stopping up the Passages of cutaneous Transpirations *.

Observations.

On examining the Substance and Structure of the Cutis, we found it to be composed of a Multitude of tendinous Fibres, single, tenacious, and interwoven, in a surprising Manner together; and the vast Number of sanguineous Vessels and Nerves, which constitute the Papillæ, and raise themselves thro' the Pores of the Corpus Reticulare. These, when the Cuticula is taken off, are very obvious in the Palms of the Hands, and under the Soles of the Feet, also at the Ends of the Fingers; whereby

* This happens oftener in the Winter, than the Summer; and this is the Reason why it is more difficult to keep the Hands clean in cold, than in warm Weather. And while we are dissecting in Winter, the oftener we wash our Hands, the less sensible they are of Cold.

we constitute the Sense Tact, or Touch, and Feeling.

What we have hitherto observed is sufficient to enable us to understand the Nature of Tact. The Papillæ, seated in the longer winding Ridges, at the Extremities of the Fingers, regularly disposed in spinal Placæ, are, by the Attention of the Mind, a little raised or erected, as appears in respect of Frights or Shiverings, as we see in the Nipples of Women, in the handling of tangible Objects, and by Friction; whereby, receiving the Impression of the Object into their nervous Fabric, it is thence conveyed, by the Branches of the Nerves, to the Brain. This is what we name the Tact, or Sense of Feeling; we become sensible of Heat when it exceeds in the Bodies of our Fingers; and Weight likewise, when it presses more than usual.

Humidity, we judge of by the Presence of Water, and Softness or yielding of the Subject: Hardness from the Resistance to the Finger: Figure, from the Limits or rough circumscribed Surface: Distance from a rude Calculation or Estimate made by Experience, to which the Length of the Arm serves as a Measure: So the Touch serves to correct the Mistakes of our other Senses.

The mucous Substance observed, first by MALPIGHIUS; moderates the Action of the tactile Subject, and preserves the Softness and sound State of the Papillæ. The Cuticula excludes the Air from withering and destroying the Skin, qualifies the Impressions of the externous Bodies, so that they may be only sufficient to affect the Touch, without causing Pain; and therefore, when it is become too thick by Use, the Sense of Feeling is either lost or lessened; but if it be thin and soft, the Feet become painful.

The most important Office is an emunctory Instrument, to perspire or exhale from the Body,

larger Quantity of Humours and other Matters, to be carried off by the Air. Accordingly, the whole Surface of the Skin vapours, by an infinite Number of ſmall Arteries, either coiled up into Papillæ, or ſpread on the Skin itſelf, which paſs out, and exhale throughout correſponding Pores of the Cuticula; although the Courſe or Direction of the Veſſels which pour out this Vapour be changed in paſſing from the Skin to the Cuticula. Theſe exhaling Veſſels or Arteries are eaſily demonſtrated, by Injection; or in living Perſons, this Exhalation is eaſily demonſtrated by a clear Looking-Glaſs being placed againſt the warm and naked Skin, whenever the Motion of the Blood is increaſed white, at the ſame time the Skin is hot and relaxed, the ſmall cutaneous Pores, in lieu of an inviſible Vapour, diſcharge Sweat, conſiſting of minute, but viſible Drops, which run together into larger Drops, by joining with others of the ſame kind. But thoſe Parts chiefly are ſubject to Sweat which are hotteſt; that is to ſay, where the ſubcutaneous Arteries are largeſt, and have a greater Action from their reſiſtance, as in the Head, Breaſt, and Foldings of the Skin. The Experiment already mentioned, together with the Simplicity of Nature herſelf, joining with the viſible Thickneſs or Cloudineſs of the cutaneous and pulmonary Exhalation, ſufficiently perſuades us, that the perſpirable Matter and Sweat are diſcharged through the ſame kind of Veſſels; and differ only in the Quantity and Celerity of the Matter, which, together with the Sweat, intermixed with the ſebaceous Humour of the Glands and the ſubcutaneous Oil, which being more plentifully ſecreted, and diluted with the arterial Juice, flows out of an oily and yellow Conſiſtence; chiefly gives that Smell and Colour to the Sweat, for which it is ſo remarkable. Hence we find it more fœtid in the

the Arm-pits, Groins, and other Parts, where those Glandules are most numerous.

Concerning the Nature of Perspiration, we are to enquire by Experiments, and by Analogy, with the pulmonary Exhalation, which more frequently and abundantly perspires a vaporous Cloud of the same Kind, more especially visible in a cold Air. That which flies off from the Body, in this Exhalation, is chiefly Water, appears from Experiments, by which the Breath being condensed in large Vessels, forms or gathers into watery Drops. Agreeable to this, we find the obscuring Vapours subtle, so as wholly to fly off again from it; and the same is confirmed by the obstructed Matter of Perspiration passing off by Urine, or more frequently changing into a Diarrhœa; and from the easy Passage of warm Liquors in the Form of Perspiration, by hot Air; or else by the urinary Passages in cold ones.

The Sweat is evidently of a saline Nature, as appears both from the Taste, and from the minute Crystals that appear to shoot upon the Cloaths of such as work in Glass-Houses; as well as by Distillation, which shews the Sweat to be of an alkaline Nature. Hence it is, that by this Discharge, the most malignant Matter of many Diseases is thrown off from the Body. But in reality, Sweats are always a preternatural or morbid Discharge, from which a Person ought always to be free, unless by violent Exercise, or other Accidents, his Constitution is for a shorter time in a diseased State. Nor is it unfrequent for Sweats to do considerable Mischief in acute Diseases, by wasting the aqueous Particles, and thickening the rest of the Blood, at the same time it renders the Salts more acrimonious. By a too violent Motion of the Blood, the Sweat is rendered extremely fœtid; and being electrified, it is sometimes lucid.

The Uses of Perspiration are to free the Blood from its redundant Water, and throw out those Particles, which, by repeated Circulation, have become alkaline, or otherwise acrimonious, and possibly to exhale therewith an extreme volatile Pill, prepared from the same Blood. The same Perspiration likewise qualifies and softens the Cuticule, which is a necessary Medium, extended before the tender sensible Papillæ.

But the same Skin that makes this Exhalation into the Air, is likewise full of small Vessels, which inhale or absorb thin Vapours from the Air, either perpetually, at least when it is very solid; more especially when the Air is damp, the Body unexercised, the Mind oppressed with Grief, or both under Considerations contrary to those Veins are demonstrated by anatomical Injections; which, if thin or watery Sweat passes through them in the same Manner as through the Arteries, moreover the manifest Operations of Medicines in the Blood, which were exhaled into the Air, or applied to the Skin, prove the same, such as the Vapours of Mercury, Turpentine, Saffron, Bath-waters, Mercurial-plasters, Tobacco, Calloquintida, Opium, Cantharides, Arsenic, with the fatal Effects of contagious or other Poisons, entering through the Air, as in the Venereal Infection; to which add the living of Animals, almost without Drink in hot Islands, which abound with most Vapours, from which, however, they sweat and piss plentifully enough. Lastly, some extraordinary morbid Cases have demonstrated thin, in which a much greater Quantity of Urine has been discharged, than the Quantity of Drink taken in. The Proportion of this Inhalation is difficult to assign; but that it is very great in Plants, more especially in the Night-time, appears evidently from certain Experiments; which may be seen in the vegetable Statics of Dr. Hales.

These

These cutaneous Veſſels, both exhaling and inhaling, are capable of Contraction and Relaxation by the Power of the Nerves. The Truth of this appears from the Effects of Paſſions of the Mind, which, if joyful, increaſe the Circulation, and relax the exhaling Veſſels, ſo as to yield eaſier to the Impulſe of the Blood; from whence, with a ſhortening of the Nerves, there follows a Redneſs, Moiſture, and Turgeſcence of the Skin. Thoſe Paſſions, on the contrary, which are ſorrowful, and retard the Circulation, contract the exhaling Veſſels, as appears from the Drineſs and Corrugation of the Skin, like a Gooſe's Skin after Frights, and from a Diarrhœa covered by Scars. But the ſame Affections ſeem to open and increaſe the Power of the exhaling Veſſels, whence the variolous or peſtilential Contagions are eaſily contracted by Fear.

Of the Membrana Adiposa and Fat.

The ſecond univerſal Integument of the human Body is the Membrana Adipoſa, or Corpus Adipoſum. This is not, however, a ſingle Membrane, but a Congeries of a great Number of membranous Laminæ, joined irregularly to each other at different Diſtances, ſo as to form numerous Interſtices; which have been named Cellulæ, and the Subſtance compoſed of them, the cellulous Subſtance.

The Thickneſs of the Membrana Adipoſa is not the ſame all over the Body, and depends on the Laminæ of which it is made up. It adheres very cloſely to the Skin, runs in between the Muſcles in general, and between their ſeveral Fibres in particular, and communicates with the Membrane, which lines the Inſide of the Thorax and Abdomen.

This Structure is demonſtrated every Day, in blowing up Meat, when newly killed; in

doing which, they not only ſwell the Membrana Adipoſa, but the Air inſinuates itſelf likewiſe into the Interſtices of the Muſcles, and penetrates even to the Viſcera, producing a kind of artificial Emphyſema.

Theſe cellular Interſtices are ſo many little Bags or Satchels, filled with an unctuous or oily Juice, more or leſs languid, which is called Fat, the different Conſiſtence of which depends not only on that of the oily Subſtance, but on the Size, Extent, and Subdiviſion of the Cells*.

That is more fluid in living, than in dead Bodies, it melts with the Heat of the Fingers in handling it, and its Fluidity is in part obſtructed by the Sacculi, which contain it. To take it intirely out of theſe Bags, the Method is to ſet the whole over the Fire, in a proper Veſſel; for then the Bags burſt, and ſwim in Cluſters in the true oily Fluid.

This Subſtance increaſes in Quantity in the Body, by Reſt and Good-living; and, in the contrary diminiſhes by hard Labour, and a ſpare Diet. Why Nouriſhment ſhould have this Effect is eaſily conceived, and it is likewiſe eaſy to ſee, that an idle ſendentary Life muſt render the Fat leſs fluid, and conſequently more capable of blocking up the Paſſages of inſenſible Tranſpiration, through which it would otherwiſe run off.

* Malpighi took a great deal of Pains about that Subſtance; that in Birds and Frogs, the Viſcera and Veſſels of which are tranſparent, he thought he ſaw a kind of Ductus Adipoſi; and that, by preſſing theſe Ducts, he obſerved oily Drops to run diſtinctly into the the ſmall Ramifications of the Vena Portæ.

The Manufacture of Soap, the Compoſition of the Unguentum Nutritum, and the different Mixtures of Oil, with ſaline and acid Liquors, give us ſome Idea at leaſt, of the Formation of the Fat, in the human Body; but the Organ which ſeparates it from the Maſs of Blood, which ought to be the Subject of our preſent Inquiry, is not as yet ſufficiently known.

Hard

Hard Labour diffolves it, and confequently fits it for paffing out of the Body, with the other of infenfible Tranfpiration. Some are of Opinion that it returns into the Mafs of Blood, by the capillary Veins and that it can, for fome certain time, fupply the Want of Nourifhment.

By this they think, the long Abftinence of fome Animals may be explained; but I am apt to believe, that the mere Decreafe of cutaneous Tranfpiration, occafioned by the continual Reft, and Inaction of thefe Animals, has a great Share in this Effect.

The proportional Differences in the Thicknefs of thefe Membrana Adipofa are determined, and may be obferved to be regular in fome Parts of the Body, where either Beauty or Ufe required it.

Thus we find it in great Quantities, where the Interftices of the Mufcles would otherwife have left difagreeable hollow or void Places; but being filled, and as it were padded with Fat, the Skin is raifed, and an agreeable Form given to the Part.

The Appearance of a Perfon moderately fat, of a Perfon extremely lean, and of dead Subjects, from which all the Fat has been removed, proves fufficiently what we obferve.

In fome Places the Fat feems to be braced down by a kind of natural Contraction in Form of a Fold; as in that Fold which feparates the Bafis of the Chin from the Neck, and in that which diftinguifhes the Buttocks from the Reft of the Thigh. We obferve it likewife to be entirely funk, or as it were performed by a kind of Dimple or Foffula, as in the Navel of fat Perfons.

Thefe Depreffions and Folds are never obliterated, let the Perfon be ever fo fat, becaufe they are not natural, and depend on the particular Con-

formations

formation of the Membrana Adipoſa, the Laminæ of which are wanting at theſe Places.

The Fat is likewiſe of great Uſe to the Muſcles in preſerving the Flexibility neceſſary for their Actions, and in preventing or leſſening their mutual Frictions. This Uſe is of the ſame Kind with that of the mucilaginous Matter found in the Articulations, as we have already obſerved.

Laſtly, the Fat, as a fine oleaginous Subſtance in its natural State, may be ſome Defence againſt the Cold, which we find makes more Impreſſion on lean than on fat Perſons. It is for this Reaſon, that to guard themſelves againſt the exceſſive Colds of hard Winters, and to prevent Chilblains; Travellers rub the Extremities of their Bodies, and eſpecially their Feet with ſpirituous Oils, ſuch as that of Turpentine, &c.

This Maſs of Fat, which makes an univerſal Integument of the Body, is different from that which is found in the Abdomen, Thorax, Canal of the Spina Dorſi, Articulations of the Bones, and in the Bones themſelves.

But the Difference of all theſe particular Maſſes of Fat conſiſts chiefly, as I have ſaid in the Thickneſs or Firmneſs of the Pellicles, in the Largeneſs or Smallneſs of the Cells and in the Conſiſtence, Fluidity, and Subtilty of the oleaginous Matter.

Observations.

The cellular Subſtance is without Fat only in a few Places, to allow a neceſſary Motion to the Skin, where it is repleniſhed with it; and ſerves to defend the internal Parts from the cold Air, to render the Skin moveable upon the Muſcles, to fill up the Cavities betwixt the Muſcles themſelves, and to render the whole Body white and uniform. The Cutis, Cuticula, and Malpighius

hius Mucus, serve not only to limit the external Bounds of the Body every where, but likewise where they seem to be perforated; passing internally, they degenerate gradually. For the Cuticula is manifestly extended into the Anus, Urethra, Vagina, Cornua of the Eye, auditory Passage, Mouth and Tongue; nor is it absent in the Stomach and Intestines, although, by the perpetual Warmth and Moisture, its Fabric be altered and extended, or relaxed into their villous Teguments. Thus the true Skin is continued into the internal Fabric of the Palate, Tongue, Pharynx, Nostrils, Vagina, &c. where it degenerates always into a white, thick Pulp, commonly called nervous Tunic of those Parts.

When the Membrana Adiposa are inflamed, and degenerate into Suppuration, in some fat Subjects, they make it very tedious in healing, as the Vesiculi soon infect one another; therefore the best Method to procure a speedy Cure is not to spare Amputation freely, if it is in a convenient Part of the Body. In some Subjects, these Cellulæ Adiposæ are an Accumulation of Fat, which forms a large Tumor, which I think is occasioned by the absorbent Vessels, which correspond to the adjacent Part where the Tumor is formed, wherefore the Arteries continually distil the oleaginous Part of the Blood into the Cellulæ.

Petit has amputated one of these Tumors from a Woman, between the Shoulders, which weighed forty eight Pounds, and we read the like in various Authors.

The sanguinous Vessels of the Membrana Adiposa are very numerous, and arise from the circumjacent Parts; entering, as it were, and surrounding the Cells of the membranous Cellulæ. The Nerves are few, and very small, whence it has little Sensation. Authors mention, besides these, certain Vessels,

ſels, which they name Vaſa Adipoſa; but it does not appear certainly, that there are any diſtinct Veſſels from thoſe we hereafter mention. That the oleaginous Matter of the Fat has a circulatory Motion, or an Egreſs into Veins, is very evident from the Conſumption of it in many Diſeaſes, which are extremely ſudden; and from its vaſt and almoſt immoderate Diminution, only from the Effect of any violent Exerciſe, or in acute Diſeaſes.

MORGAGNI is of opinion, that the Epidermis is nothing elſe but the Superficies of the Cutis, which grows hard, and as it were, in ſome degree, callous, by the external Compreſſion; thence indurates to be inſenſible, and, as it were, dead. But we obſerve that the Epidermis is perfectly formed in the Fœtus State, while in Utero, when there have not been theſe Cauſes of Induration; where the whole Surface of the Body has been ſurrounded by the Liquor Amnii, which is ſoft and mucilaginous, and by no means capable of making ſuch a Compreſſion of Induration.

RUYSCH tells us, in his Averſaria, how to prepare, in a beautiful Manner, the Cuticula and Corpus Reticulare of MALPIGHI.

SWAMMERDAM and ST. ANDRE do not only ſay the Epidermis has Veſſels, but to have injected them; but I am rather apt to think that they took the Injections which run under it in the Cutis, which will make it appear as if the Epidermis was really injected, but we find the contrary, when we take it off from the Skin.

Beſides this reticular Subſtance, there is another, which may be called properly enough the Rete Cutaneum, or Rete of the Cutis. This is formed by the Veſſels, which are diſperſed all over the Skin: Theſe Veſſels receive in general, no other Fluid but Lymph; and to that it is owing; that the whole Surface of the Body with us is white. It has been ſuppoſed

ſuppoſed, that in Negroes this reticular Subſtance was formed of larger Tubes; and from hence, Authors have argued, that in conſequence of their larger Sizes, theſe Veſſels may have received Blood into them in thoſe Subjects, and that this Blood diveſted of its Lymph and other aqueous Matter by Tranſpiration, became black in them, and was the Occaſion of their black Colour. This has a Shew of Reaſon; but we are at preſent very well aſſured, that the black Colour of theſe People is ſolely and entirely owing to a black Matter, of a peculiar Kind, lodged in the Corpus Reticulare, though we are not acquainted with its Origin.

There are People always of a florid red Colour, from the Blood in the Veſſels of the Skin, not being diveſted of its Lymph; and in general, according to the Nature of the Blood and other Liquors which enter theſe Veſſels, the Skin is differently coloured. We are not to ſuppoſe it wonderful, that the Veſſels of the Skin are not exactly of the ſame Size in all People; for we find that they vary extremely in this Particular, in the different Parts of the Body in the ſame Perſon. In the Cheeks, they are naturally very large, whence there is in general a florid Colour there; and the Blood being capable of ruſhing into them on any Occaſion, it is in them, that Fluſhings of red are firſt ſeen from Exerciſe, or a thouſand other Occaſions. In many of our Paſſions, the nervous Fluid being forced violently along its Paſſages, they preſs upon the Arteries, and force the Blood into the lateral Tubercles, which form this reticular Subſtance; hence it is, that we grow red with theſe Paſſions. If the Paſſion be more violent ſtill, and the nervous Fluid urged on with greater Force, the Arteries may be ſo preſſed upon, as to prevent the Blood's paſſing at all along its own little Canels; and to this

this it is owing, that we turn pale with Anger, and with many other very violent Paſſions.

The ſame Conſequence will happen alſo, tho' on another Principle, if, on the contrary, the nervous Fluid is not propelled at all, for want of Force in the Nerves: In this Caſe the Heart will not ſend the Blood at all into theſe minute Veſſels, and conſequently we become pale, as in the other Caſe. This is the Origin of the Paleneſs, which ſeizes us in Terror, &c.

The Nails.

The Nails are looked upon by ſome as Productions of the cutaneous Papillæ; and by others as a Continuation of the Epidermis. This laſt Opinion agrees with Experiments made by Maceration, by Means of which the Epidermis may be ſeperated entire from the Hands and Feet, like a Glove with the Nails.

In this Experiment, we ſee the Nails part from the Papillæ, and go along with the Epidermis, to which they remain united like a kind of Appendix, and yet their Subſtance and Structure appear to be very different from that of the Epidermis.

Their Subſtance is like that of Horn, and they are compoſed of ſeveral Planes of longitudinal Fibres ſoldered together. Theſe Strata end at the Extremity of each Finger, and are all nearly of an equal Thickneſs, but of different Breadths, and Lengths.

The external Plane or Stratum is the longeſt, and the reſt decreaſe gradually, the inner, moſtly being the ſhorteſt; ſo that the Nail increaſes in the Thickneſs from its Union with the Epidermis, where it is thinneſt, to the End of the Finger where it is thickeſt.

The

The graduated Extremities or Roots of all the Fibres of which these Planes subsist, are hollowed for the Reception of the same Number of very small oblique Papillæ, which are Continuations of the true Skin; having reached to the Root of the Nail, form a semi-lunar Fold, in which the Root is lodged.

After the semi-lunar Fold, the Skin is continued on the whole inner Surface of the Nail, the Papillæ insinuating themselves in the Manner already said. The Fold of the Skin is accompanied by the Epidermis, to the Rete of the Nails exteriorly, to which it adheres very closely.

Three Parts are generally distinguished in the Nail, the Root, Body, and Extremity. The Root is white, and in Form of a Crescent; and the greatest Part of it is hid under the semi-lunar Fold already mentioned.

The Crescent and the Fold lie in contrary Directions to each other. The Body of the Nail is naturally curvated, transparent, and appears of the Colour of the cutaneous Papillæ which lie under it. The Extremity of the Nail does not adhere to any thing, and still continues to grow as often as it is cut.

The principal Use of the Nail is to strengthen the Ends of the Fingers and Toes, and to hinder them from being inverted towards the convex Side of the Hand or Foot, when we handle or press upon any thing hard. For in the Hand, the strongest and most frequent Impressions are made on the Side of the Palm, and in the Foot on the Sole; and therefore the Nails serve rather for Buttresses, than for Shields.

Observations.

The Nail itself is of a soft tender Fabric where it first arises, partly covered by the Skin; but by Age and Contact with the Air, it, in time, hardens

into a ſolid, horny, and elaſtic Body, compoſed of long Hair like Filaments, cemented together by interpoſed Glue, and diſtinguiſhable from each other, by intervening Sulci, by which one may be able to ſplit them into a Number of leſſer Orders.

The Nail, thus formed, extends itſelf to the Extremity of the Finger, and is in this Tract lined all along internally within its concave Surface, by an Expanſion of the Cutis, and ſubjacent Perioſteum intermixed, the Filaments of which ariſe firſt ſhort, and are afterwards continued to a great Length, till they become longeſt of all at the Extremity of the Nail. Over, or upon, the external Surface of the Nail, ſome Part of the Skin is again folded, but free and diſtinct about it. The Tendons, however, do not reach quite ſo far as the Nail.

The Subſtance of the Nails. They are compoſed of the cutaneous Papillæ, elongated and indurated, firmly connected to one another in a longitudinal Direction; for this Reaſon, they are very ſenſible at the Roots, when theſe Papillæ are yet tender: But at the Apex, where they are perfectly indurated, they may be cut without Pain.

Among the various Animals, the Claws, which are analogous to our Nails, ſerve them for ſeizing and tearing their Prey, and for climbing the Trees, as, Squirrels, &c. make the latter Uſe of them; the Beaſts of Prey in general, the former. Among the other Animals, in ſome they ſerve as Shoes to to walk on: In others, they anſwer both this Purpoſe and that of offenſive Weapons, as in Horſes, to ſtrike with, &c. Vid. SCHRADER, Diſſert. de Armatura Brutorum.

THE HAIRS.

The Hairs belong as much to the Teguments as the Nails. They are a kind of Reeds or Ruſhes, the

the Roots or Bulbs of which lie toward that Side of the Skin, which is next the Membrana Adipoſa. The Trunk or Beginning of the Steam perforates the Skin, to a certain Diſtance, which is very various in the different Parts of the Body.

When the different Hairs are examined by a Microſcope, we find the Roots more or leſs oval, the largeſt Extremity being either turned toward, or fixed in, the Corpus Adipoſum. The ſmalleſt Extremity is turned toward the Skin, and in ſome Places fixed in it.

This oval Root is covered by a whitiſh ſtrong Membrane, in ſome meaſure elaſtic, and it is connected either to the Skin, to the Corpus Adipoſum, or to both; by a great Number of very fine Veſſels and Filaments.

Within the Roots, we obſerve a kind of Glue, ſome very fine Filaments which advance toward the ſmall Extremity, where they unite and form the Steam, which paſſes through this ſmall Extremity to the Skin. As the Uapour paſſes through the Root, the external Membrane is elongated in Form of a Tube, which cloſely inveſts the Steam, and is entirely united to it.

The Steam having reached the Surface of the Skin, pierces the Bottom of a ſmall Foſſula between the Papillæ, or ſometimes a particular Papilla, and there it meets the Epidermis, which ſeems to be inveſted round it, and to unite with it entirely. A Sort of unctuous Matter tranſudes through the Sides of the Foſſula, which is beſtowed on the Stem, and accompanies it more or leſs, as it runs out from the Skin, in Form of a Hair.

Hairs differ in Length, Thickneſs, and Solidity, in the different Parts of the Body. Thoſe on the Head, are called in Engliſh by the general Name of Hairs; thoſe which are diſpoſed Archways above the Eyes, Supercillia, or the Eye-brows;

 thoſe

thoſe on the Margins of the Palpebra, Cilia, or the Eye-laſhes; and thoſe which ſurround the Mouth, and cover the Chin, the Beard. In other Parts of the Body, they have no particular Names; and their different Lengths, Thickneſſes, in all theſe Parts, are ſufficiently known.

Their natural Figure ſeems to be rather cylindrical than angular, which is chiefly accidental. Their Colour is probably the ſame with that of the Glue, or medullary Matter of the Root; the different Conſiſtence of which makes the Hairs more or leſs hard, flexible, &c. Laſtly, their ſtrait or crooked Direction muſt depend on that of the Pores, through which the Stems paſs.

The Uſe of the Hairs, with reſpect to the Human Body, in general, is not ſufficiently known to be determined with Certainty. Their Uſes, with regard to ſome particular Parts, may be diſcovered, as we ſhall ſee in the Deſcription of theſe Parts; and are found to be unequal, irregular, and often knotty; they are pellucid, but not hollow; the Extremities of them are often ſplit into ſeveral Portions.

The Portion of the Hair, which is within the Cutis, is concave and vaſculous, in the Manner of the Baſis of the young Feathers in Birds: This vaſculous Portion is incloſed in a Follicula, and is moſt obvious in a Cat's Whiſker, or the Beards of other Animals.

The Origin of the Hairs is in the Cutis and Fat; probably from the Nerves alſo, as there is a very acute Pain felt in pulling them off. See Chirac. Suppl. II. Act. Eruditorum, Tom. VIII.

The nutritious Matter of the Hair is probably the ſame with that of the other Parts of the Body, not merely excrementitious, as the Ancients thought; as there are, upon the internal Surfaces of all the Cavities of the Body, exhaling Arteries which

which perpetually throw out a fine Fluid to moisten and cuticate the Parts; so there are bibulous Veins which take it up; whose Existence is proved, not only by no Liquors being in Health collected in these Cavities, but also by anatomical Injections.

Besides the Teguments, which I have here described, the Ancients reckoned two others, the Panniculus Carnosus and Membrana Communis Musculorum.

The Panniculus Carnosus is found in Quadrupeds, but not in Men, whose cutaneous Muscles are very few in Number, and most of them of a very small Extent, except that which I call Musculus Cutaneus in particular; but even that Muscle cannot in any tolerable Sense be reckoned a common Tegument.

There is no common Membrane of the Muscles, which covers the Body like a Tegument; it being no more than particular Expansions of their aponeurotic Membrane.

The Elongations of the Lamina of the Membrana Adiposa, or Cellularis, may likewise have given rise to this Mistake, especially in such Places, where this Membrane is closely united to the proper Membrane of the Muscles.

OBSERVATIONS.

FROM DR. WHYTT'S PHYSIOLOGICAL ESSAYS.

The absorbent Veins of the Body which, like those of the Intestines, have no Valves, take up by their Attraction as capillary Tubes, the rarified Vapour of the Arteries; after which, it is conveyed on, to the sanguiferous Veins in which they terminate, by their vibrating Motion, the Pulsation of adjacent Arteries, and the Compression of Muscles. The

Abſorption in the Cavities of the Abdomen and Thorax is greatly promoted by the alternate Preſſure of the Muſcles concerned in Reſpiration; while the Muſcles of voluntary Motion, employed in all kinds of Exerciſe and Labour, by accelerating the Motion of the Fluids, in the abſorbent Veſſels of the Trunk, and Extremities of the Body, enable them to imbibe more copiouſly. And hence we may ſee, why Animals which move little are oppreſſed with Fat, while thoſe kept at hard Labour, are very lean. In the former, the abſorbent Veſſels of the fatty Cells, imbibe the oily Matter depoſited there very ſlowly, becauſe they want the alternate Preſſure of the Muſcles of voluntary Motion, to puſh their contained Fluid anteriorly to the larger Veins; in the latter, the Abſorption from thoſe Cells is not only increaſed by the various and continually repeated Preſſures of the acting Muſcles, but the Body being, by much Exerciſe, in ſome meaſure, exhauſted of Fluids, the Veins imbibe more greedily, while the ſecerning Arteries pour forth their oily Liquors more ſparingly.

If the exhalant Veſſels of any Cavity throw out too much, or if the abſorbent Power of the Veins be weakened, or if both theſe happen together, a water Fluid will be collected in it; and in this way, are produced Anaſcites, Hydrocele, Hydrops, Pectoris, &c.

When the Blood is thin and watery, and the Veſſels weak, an æſarcous Oedemetous, and other dropſical Swellings are common; for, as the bibulous Veins can, by their Attraction, only take up Fluids in Proportion to the Depletion, they ſuffer by Means of their own vibratory Contractions, and the alternate Compreſſion of neighbouring Arteries and Muſcles; their abſorbing Power muſt neceſſarily

ceſſarily be leſſened in a lax State of the Fibres, where thoſe Cauſes are much weakened.

Further, while the Redundance of watery Fluid in the Blood increaſes the Exhalation by the ſmall Arteries, it leſſens the Imbibition by the Veins, for the ſame Reaſons that Aſhes, Sugar, or Salts, when moiſtened, attract the aqueous Particles of the Air, leſs ſtrongly than when they are dry.

Again, altho' there be little or no Fault in the Blood itſelf, yet, if its Return from any Part to the Heart, be much retarded, a Dropſy of that Part will ſoon follow, becauſe the Fluids, taken up by the Abſorbents, will ſlowly, and not without Difficulty, be received into the large ſanguiferious Veins; and as we have juſt now obſerved, their Abſorption muſt be in Proportion to their Depletion. Hence we ſee, ſcirrhous Tumours, Ligatures, and whatever compreſſes the Veins, ſoon bring on dropſical Swellings.

It alſo appears, from what has been ſaid, in what manner Diuretics and Purgatives carry off the ſtagnating Waters, in any Aſcites and other Dropſies: Since, as, by the Diſcharges, they make by the Kidneys and Inteſtines, they not only leſſen the Quantity of watery Fluid in the Blood, but alſo, by their Stimulus, increaſe the Force of their Circulation; the Exhalation by the Arteries muſt be leſſened, at the ſame Time that the Imbibation by the Veins is increaſed.

The Surface of the Skin and Veſſels of the the Lungs are, like the other Surfaces in the Body, endowed with exhaling Arteries and abſorbent Veins; by the former, there is perpetually diſcharged from the Blood, a fine lymphatic Fluid; and, by the latter, the watery Particles floating in the Air are conſtantly conveyed into it.

When the Air is moiſt, and the Body has been exhauſted by Fatigue, the Imbibition of thoſe

Veins often exceeds the Exhalation by the Arteries; as the Drs. KEILL and LINNING have obſerved; (Medicin Stat. Britain. tab. iv, & obſervat. & Philoſoph. tranſact. 20. 470.) but, taking the whole Year round, the Perſpiration made by the Skin and Lungs, exceeds their Imbibition, by about forty Ounces a Day in Great Britain, and fifty four Ounces in South Carolina; which, tho' it has been commonly reckoned the Total of the Perſpiration, is really no more than its Exceſs above the Quantity of Fluid, taken in by the abſorbent Veins of the Skin, Fauces, and Lungs.

The remarkable Imbibition of the Skin obſerved by Dr. LINNING, July 3. 1740, betwixt 2 $\frac{3}{4}$, and 5 $\frac{1}{8}$ afternoon, happened, tis true, without any preceding Fatigues; but is eaſily accounted for, from his having in that Time, diſcharged 28 $\frac{6}{8}$ Ounces of Urine: Since ſo great a Waſte of the thinner Parts of the Blood muſt not only have diminiſhed the Exhalation by the cutaneous perſpiring Arteries, but alſo have increaſed the abſorbent Power, of the imbibing Veins every where thro' the Body: and hence it is, that in a Diabates, the Urine often not only exceeds the Quantity of Liquors drank, but theſe are taken up ſo greedily by the abſorbent Veſſels of the Stomach and Inteſtines as to be diſcharged by the Kidneys, before one would have thought they had got into the Blood.

Although in Vegetables, the Veſſels, which perſpire in the Heat of the Day, frequently aſſume a contrary Office in the Night Seaſon, and imbibe the Dew and watery Particles, then floating in the Air; yet it does not ſeem probable, that the exhaling or perſpiring Veſſels of Animals can thus become imbibing ones, or that the Moiſture of the Air can be, by them conveyed into the Blood: Since any Motion in theſe Veſſels, from their Extremities

mities to their larger Trunks, muſt be in Oppoſition to the Courſe of the arterial Fluids.

The Imbibition by the Veſſels of the Skin is performed in the ſame Manner, as in the other Abſorbents; only it is probable, that the perpetual varying Oſcillations of the external Air may concur in promoting it. Although the Exhalations from animal, vegetable, and mineral Bodies, may be tranſmitted, along with the aqueous Particles in the Air, into the Blood; by the abſorbent Veins of the Skin and Lungs, and thus account for peſtilential and epidemical Diſeaſes raging at particular Seaſons; yet it is by no means probable, that the elaſtic Air can be imbibed by theſe Veſſels, and thus conveyed into the Blood, for it has been obſerved that this Fluid moves with greater Difficulty thro' capillary Glaſs Tubes, tho' ſome hundred times larger than the Pores of the Skin*; and it is well known, that Water and other Fluids can penetrate many Subſtances there, which Air cannot paſs.

This Obſervation of the Difficulty, with which, Air moves thro' capillary Tubes, may ſerve to determine a Controverſy which has long ſubſiſted among Phyſiologiſts, viz. Whether or not any elaſtic Air enters into the Blood by the Lungs. For, ſince a few Drops of Water, with ſmall Portions of Air between them, in a capillary Tube, requires a greater Force, to make them aſcend, that with which the Tube attracts the Particles of that Fluid; (Muschenbroeck Loc. citat.) It muſt follow, that if any alaſtic Air were admitted into the abſorbent Veins of the Lungs, it would

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* Arem verò non niſi tardè & cum quâdam Tenacitate per hos Tubos moveri, ſemper docuit Experimentia; Arëi enim ineſt Species quædam Tenacitatis aut Immobilitatis, Muschenbroeck de tub. capill. vitri. Cap. 1. Exp. XI.

not only move through them itself, but hinder their taking up, by their Attraction, any other Fluids.

The prodigious Swelling of Animals, in an exhausted Receiver, further shews, that Air cannot readily pass through the small Pores of the Skin and Lungs. Nor is it any Objection to this Doctrine, that Air has been found in the Cavities of the Heart; since, in a morbid State, this might arise from the Blood of which Air is a constituent Part, as well as of other Fluids. HALES's statical Essays, Vol. I. Chap. vi.

It is very observable, that Air injected into the Veins of an Animal produces Obstructions, Concretions, and sudden Death; which Effects, however, may be easily accounted for, from the Power which Air has of coagulating Blood, and from the surprising Influence it has in stopping the Motion of Water, even in large Pipes, especially when lodging in their Fluxes. Philosoph. Transact. N°. 393.

But, to return; as the Efluvia of different Substances floating in the Air, are, by means of the cutaneous Absorbents, conveyed into the Blood, so likewise are the finer Parts of Plasters, Cataplasms, Fomentation, and all other external Applications; which ought therefore to be considered, not only as having a topical Influence, but also as acting upon the whole Body by their subtiler Parts, which are mixed with the Blood and other Fluids.

It may be thought a Difficulty, that Quick-silver applied in the Form of an Ointment, should be taken in so readily by the absorbent Vessels of the Skin, since, as has been observed above, it passes through the Intestines without getting into the Lacteals. But this happens from the Particles of the Mercury being externally divided and so united with those of the Grease as to enter the Pores of the

the Skin along with them: for, tho' Quick-ſilver is repelled by capillary Glaſs Tubes, yet, if their internal Surface is run over with melted Greaſe, it will be attracted by them*.

We are told, that, upon opening the Bodies of ſuch as had taken Mercury in large Qunatities, this Fluid has been ſometimes found in the Cellules of the Bones and elſewhere †; the Reaſon of which may be eaſily underſtood from what has been ſaid above: For, if the very ſubtile and greatly divided Particles of Mercury ſhould, after they are thrown out, by the exhaling Arteries, into any Cavity of the Body along with the finer Parts of the Blood, unite their ſtrong mutual Attraction; ſo as to form Globules whoſe Diameters are larger than the Diameters of the abſorbent Veins, it is evident they could never be taken up by theſe Veſſels, but muſt remain for ever in ſuch Cavity.

To conclude our Obſervations on the abſorbent Veſſels of Animals; it may not be improper to take Notice, that there are, upon the internal Surfaces of the Foliclles, ſecretory and excretory Ducts of the Glands, bibulous Veins, whoſe Office is to carry off Fluids, which would be improper to enter into the ſeveral Secretions. And, if we ſuppoſe theſe abſorbent Veſſels, like other capillary Tubes, to attract, according to their different Natures, different Fluids, more or leſs ſtrongly, we ſhall ſee one great Cauſe of the various Secretions performed in the Bodies of Animals.

* Memoires de l'Academ. des Sciences, An. 1724, & MUSCHENBROECK de Tub. capill. Cap. iv. Exp. 12. Cor. 2. & Cap. vii.

† WEPFER de Appolex. p. 277. and MEAD on Poiſons. Edit. 1. iii.

LEC-

LECTURE XIV.

Of the MYOLOGY.

ALL the Motions of the Human Body, whether General or Particular, Natural or Preternatural, are immediately performed by Organs, which Anatomiſts name Muſcles; and theſe are found in all the moveable Parts of the Body.

The Muſcles in general are a Faſciculi of Fibres, of different Figures and Sizes, and, for the moſt part, conſiſting of two different Portions; one whereof is thick, ſoft, more or leſs red, and ſometimes pale, forming what is called the Body, fleſhy Subſtance, or Belly of the Muſcle. The other is thin and ſmall, of a cloſe Contexture, and very White, forming the Extremities and other Parts, termed Tendons or Aponeuroſes. The fleſhy Portion is the principal and eſſential Part of the Muſcle, being never wanting; but the tendinous or aponurotic Portion is, in ſome Muſcles, ſo very ſmall, as to be inviſible. Both Portions are covered by a particular Membrane.

The Fibres, of which a Muſcle is compoſed, go by the general Name of Moving Fibres, and each of them, as well as the whole Muſcle, is partly tendinous, and partly fleſhy.

They are, for the moſt part, collected in Faſciculi, laterally, with reſpect to each other; and

and diſtinguiſhed by membranous, cellular or adipoſa Septa, as by ſo many particular Vaginæ.

Theſe Fibres are connected to each other, and to the intermediate Septa, by a great Number of very ſmall fine Filaments, the capillary Extremities of Arteries, Veins, and Nerves, running over them, and they are incloſed in a thin membranous cellular Covering, called the proper Membrane of the Muſcle, being a Continuation of the Septa or Vaginæ, already mentioned.

All theſe Septa or Vaginæ communicate with each other, by a mutual and reciprocal Continuation of their cellulous Texture, and they are fixed tranſverſly by filamentous or fibrous Pellicles, which croſs them at ſmall Diſtances from one another, and lie nearly in the ſame Direction, through the whole Body of the Muſcle. The ſame ſort of Fræna, are obſervable between the moving Fibres, which connect them, and appear to be in ſome meaſure nervous.

The particular Structure of each moving Fibre, is not yet ſufficiently known. They may all be divided into ſeveral Fibulæ; and the Subſtance of their Fleſhy Portion, is believed by ſome to be cellulous or veſicular, and by others, ſpongy or medullary. Some of the Ancients imagined this Portion to be concave, and that it contained a Sort of Pulp, called by them Tomentum more or leſs ſaturated with Blood. And they compared a Muſcle to a Rat, or other Animals fleaed, and divided it into Head, Belly and Tail.

When we examine a moving Fibre through Microſcopes, both the fleſhy and tendinous Parts of it appear contorted, but the latter not ſo much as the former. Having injected any coloured penetrating

penetrating Liquor, we may, by the Help of a Microfcope, difcover a very fine and clofe vafcular Texture, which infinuates itfelf between all the Fibres, covering or being twifted round them, and likewife fpread on the Septa.

The flefhy Portion may be contracted or fhortened, and relaxed or elongated.

The tendinous Portion yields but very little, refifting any Force tending to prolong it, except it be fo violent as to diforder its Texture.

The Difpofition of the moving Fibres is different in different Mufcles, and their tendinous and flefhy Portions, not always lie in the fame ftrait Line, but make oppofite Angles with each other. In fome Mufcles, the flefhy Portion is not all of the fame Length; in others it is nearly equal, but the Fibres unequally and gradually difpofed at the Sides of each other, forming all together an oblique Plane.

Some are difpofed like Radii, others form Planes, more or lefs, incurvated; and fome complete Circumferences, the two Extremities, meeting and uniting together.

The tendinous Portions being only the Supplement of the whole Length of the Mufcle, may be of equal or unequal Lengths, according to the Difpofition of their Infertions. They may be very fhort at one End of the Mufcle, and very long at the other. When the flefhy Plane is partly oblique, they vary gradually in Length, and when that Obliquity is reciprocal, at both Ends, in Form of a Lozenge, the tendinous Portions are alternately long and fhort.

In fome Mufcles, each moving Fibre is nearly of the fame Length with the Body of the Mufcle; in others, the flefhy Fibres are very fhort, though the Body of the Mufcle formed by them,

be

be very long. In the firſt Kind, the Fibres, run more or leſs ſtrait from one End to the other, and are never very numerous.

In the Second, they are ſituated obliquely, and are conſequently in great Numbers; ſo that the Length of each Fibre, is not always to be meaſured by that of the Body of the Muſcle to which it belongs.

Theſe different Portions of Fibres are not to be met with equally in all Muſcles. Some have two or more Tendons, ſome only one, but of different Lengths; others have none at all, or at leaſt none that can be perceived, as has been already ſaid.

But there is no Muſcle without a fleſhy Portion, (properly ſpeaking) which alone being capable of Contraction, is abſolutely neceſſary; whereas the Tendons in many Places, are only Productions, by which the Muſcles are fixed to Parts at a Diſtance from them.

Many Muſcles are obſerved to be covered by an aponeurotic Expanſion of different Degrees of Strength and Size, which ſeems to ariſe from one or more of the neighbouring Tendons.

In Proportion as it is extended, it grows thinner, and then loſes itſelf in the cellular Membrane of the Muſcles.

There are likewiſe ſtrong ligamentary Membranes of another Kind, by which many Muſcles, are covered by a Girth. They are compoſed of ſeveral Laminæ, of ſtrong white ſhining Fibres, croſſing each other, and they are ſtrongly fixed along one or more Bones, almoſt in the ſame Manner as the inter-oſſeous Ligaments of the Fore-Arm and Leg. They furniſh Septa or common Vaginæ to the Muſcles which they cover, and likewiſe particular Vaginæ to the Tendons, thinner than thoſe of the fleſhy Portions.

Theſe

Theſe common Laminæ and Vaginæ ſerve to gird and confine the Muſcles, and to keep them in their Places in great Efforts. They likewiſe, in ſome Meaſure, ſupply the Place of Tendons, and multiply the Inſertions. The looſe Portion of theſe Membranes are lined on the Inſide with other very fine Membranes, which are continually moiſtened by a mucilaginous Liquor, to preſerve the Muſcles and Tendons, contiguous to them, from Friction.

Beſides theſe Laminæ and Septa, there are other ligamentary Fræna peculiar to the long Tendons, called by the Name of Annular Ligaments, the general Hiſtory of which is to be found in the Deſcription of the freſh Bones.

The Difference of Muſcles is very conſiderable, and depends on many Circumſtances, the chief of which are the Size, Figure, Direction, Situation, Structure, Connection, and Uſe; and it is from theſe Differences that the Names of the greateſt Part of the Muſcles are taken. From their Size, they are termed Great, Middle, Small, Long, Broad, Thin: From their Figure, Triangular, Scalenous, Square, Rhomboïd, Indented, Orbicular, Deltoïd: From their Direction, Strait, Oblique, Tranſverſe: From their Situation, Superior, Inferior, External, Internal, Anterior, Poſterior, Right, and Left: Theſe four Differences, and the Names derived from them, are eaſily comprehended; but what relates to the other three, requires a little farther Explication.

With reſpect to their Structure, Muſcles are either ſimple or compound.

Simple Muſcles are thoſe whoſe fleſhy Fibres, or rather the fleſhy Portions of their moving Fibres, are all uniformly diſpoſed, and terminate in Tendons, lying either in a ſtrait or oblique Line in the Manner already explained.

Com-

Compound Mufcles are thofe whofe flefhy Fibres are difpofed obliquely in feveral particular Ranks, reprefenting the fame Number of fimple Mufcles, with the Fibres lying in oppofite Directions. In proportion to the Number of thefe Ranks or Series, the Mufcle is faid to be more or lefs compounded.

When the compound Mufcle is formed of two fimple Mufcles, only, thefe are fo difpofed as to reprefent a Feather, and the compound Mufcle is from thence termed Penniform. In fome of thefe Mufcles one of the Tendons appears to be flit or divided, in order to contain the flefhy Portion between its two Parts, while the other runs through the Body of the Mufcle, diminifhing gradually in Size it advances, in the fame Manner as we fee a Feather. In others, there is only one middle Tendon between the Series of flefh Fibres, which are by their other Extremity fixed to other Parts. In more compound Mufcles, the Tendons at one Extremity may all unite together, while thofe at the other remain divided.

But there are ftill other Kinds of compound Mufcles; fome are made up of two, placed endways, and connected together by a common Tendon; fo that this Tendon, the two Mufcles, and the two Tendons at their Extremities, lie all in a Line, and form the whole Length or Extent of the compound Mufcle, which is termed DIGASTRICUS, or BIVENTRIS; and if three Mufcles be thus connected, the Compound is called TRIGASTRICUS.

Some are compofed of two Mufcles more or lefs in a lateral Situation, with refpect to each other, and united at one Extremity; others are compofed of three or four Mufcles, fituated in the fame Manner; and if they are united at that Extremity, which the Ancients called the Head of

the Mufcle, they are called Bicipites, Tricipites, &c. according to the Number of thefe Heads; but if they are connected at the other Extremity, they are termed Bicornes, Tricornes, &c.

The Mufcles are fixed by their Extremities to different Parts, and in different Places of the Body; the greateft Part of them are inferted in Bones alone. Some are fixed partly to Bones, and partly to Cartilages, as thofe of the Ear and Nofe; fome partly to Bones, and partly to the Integuments, as feveral Mufcles of the Face, which may therefore be termed Semi-cutaneous. In fome, the Fibres make an entire Circle, without terminating any where by their Extremities; of this Kind are feveral of thofe called Sphincters, to which may be added the Heart, Stomach, and Inteftines. All the Mufcles have likewife a Sort of Connection with the neighbouring Parts, but this is only lateral, by means of Membranes.

The Names, taken from the Connections and Infertions of Mufcles, are generally of two Kinds; one Common and referred to fome confiderable Part of the Body, as when we fay the Mufcles of the Head, of the Thorax, Abdomen, Arm, Leg, Eye, Lip, &c. The other Proper, fpecifying more particularly the Infertions of each Mufcle, as the Maftoïdeus, Sterno-Maftoïdeus, Coraco-Brachïalis, Anconeus, Peroneus, &c. Some Names have no Relation to the Infertions, as thofe of Ulnaris and Radialis, which are given to Mufcles which lie upon the Ulna and Radius, without being inferted in either Bone.

The Names of the firft Kind relate more to the Ufes of Mufcles, than to their Infertions, and are, for the moft Part, ill founded and apt to miflead us, as will appear when we come to the Ufes of the Mufcles. The Names of the fecond kind, are Inftructive, and thofe of the Third are Tolerable.

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The general Ufe of the Mufcles is to move all the Parts of the Body, whether hard, foft, or fluid. Moft of the hard and foft Parts are moved by thefe Powers being fixed to them, and they move the reft without any fuch Infertion.

The Mufcles fixed by both Extremities to hard Parts reciprocally moveable, may accordingly move either Part. Thus the Mufcles inferted by one Extremity to the Os Humeri, and by the other to the Ulna, may move the Ulna upon the Ulna upon the Os Humeri upon the Ulna.

Mufcles fixed by one Extremity to hard Parts, and by the other to foft Parts, cannot perform thefe reciprocal Motions, becaufe, in this Cafe, the hard Parts muft remain immoveable, the foft Parts only being moved, as in the Mufcles of the Ball of the Eye, thofe of the Lips, &c.

The Fluids, of whatever Nature or Confiftence they be, are moved in fome Cafes, by being immediately pufhed or projected by the Mufcles, as we fee in the Heart, in others by their Canals being preffed upon, as in the oblique and tranfverfe Mufcles of the Abdomen; and there are other Mufcles which ftop or retard the Motion of the Fluids at one Time, and facilitate or accelerate it at another, as all the Sphincters.

The Ufe of each Mufcle in particular is confined to the Motion of one or more moveable Parts; fome Parts require a certain Number of Mufcles to move them, whereof fome act one way, and fome another. Several Mufcles, for Inftance, move the Os Humeri upon the Scapula, and of thefe fome raife, others deprefs it; fome turn it anteriorly, fome pofteriorly, and others round upon its Axis, &c. In like Manner, the Fore-arm is moved upon the Os Humeri, by certain Mufcles, whereof fome extend it, and others bend it.

The general Enumeration of the Muſcles of the human Body, which is commonly made, is founded on their ſuppoſed particular Uſes. We meet Liſts of the Muſcles of the Head, of the Thorax, Abdomen, Extremities, Eye, Noſe, Lips, &c. and to the different Muſcles ſaid to belong to each Part, Names are given, ſpecifying ſome determinate Uſes; ſuch as Raiſers, Depreſſors, Abductors, Adductors, Flexors, Extenſors, &c.

This Method of diſtributing and naming Muſcles, is very well ſuited to the Memory, and may be retained for thoſe that are not entirely, or not at all fixed Bones; but with reſpect to thoſe Muſcles, which are inſerted in Bones alone, this way of talking is very capable of miſleading Beginners, of begetting falſe Ideas, of obſtructing the Progreſs of Knowledge, and even of making able Philoſophers, Phyſicians, and Surgeons fall into conſiderable Miſtakes.

It leads us naturally into ſeveral Errors, as for Inſtance; that the Parts to which a certain Number of Muſcles is attributed, cannot be moved by other Muſcles; that the Muſcles ſaid to belong to one Part, can move no other Part; that the Muſcles, whoſe Uſes are limited and determined by certain Names, can have no other Uſes; and that the Muſcles, ſo named, may have the Uſes aſſigned to them, in all the different Situations of the Parts, to which they are fixed. It is however abſolutely neceſſary, for the ſake of Memory, to divide the Muſcles into Claſſes, and afterwards to ſubdivide each again.

To ſhun the Inconveniences already mentioned in the Muſcles fixed only to Bones, Winslow diſcards the Names taken from the Parts, to which theſe Muſcles are commonly attributed, from the Uſes aſſigned to them; and retains as much as poſſible, the uſual Names, which expreſs only the Inſer-

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tions or other Circumftances, that he may avoid all Affectation of Novelty; and when I find myfelf obliged to change a Name, I fet down the common Name, after that which has appeared to me to be more natural and agreeable.

On this Plane it will be neceffary to defcribe feparately, all the Mufcles which are wholly inferted Bones, and not to explain their Ufes, till they have all been defcribed, they being fo nearly related to one another, that it is very difficult to fpeak of the Ufes of any one, without mentioning feveral others.

When feveral concur nearly in the Motions, they are termed Congeneres, thofe which act in oppofite Directions are relatively and alternately called Antagonifts. Thus all the Mufcles, which extend or bend the Fore-arm, are Congeneres, and thofe which extend it, are Antagonifts to the Flexors; and thefe again reciprocally Antagonifts to the Extenfors.

There muft at leaft be two Mufcles to intitle them to the Name of Congeneres, but that of Antagonift may be given to one Mufcle as well as to feveral. Many Mufcles contribute to the fame Motion, without being Congeners, viz. whereby acting in an oblique Direction, they produce a third Motion, which is direct and determinate. This is termed a combined Motion, and may fucceffively continued continued in different Directions, as that of the Arm in turning a Sling, or the Handle of any heavy Machine. Laftly, When all the Antagonifts on every Side or all the Mufcles that move a Part, act equally, and keep the Part fixed in a middle Direction, between all the Motions of which it is capable, they are faid to be in a Tonic Motion.

To move any Part, or to keep it in a determinate Situation, all the Mufcles belonging to it,

must co-operate, some of them drawing the Part directly to the Situation or Attitude designed some moderating this first Motion, by acting in a contrary Direction, and others directing it laterally. The first kind of these Muscles, we call Movers, the second Moderators, and the third Directors.

All these Kinds are to be found in the Articulations by Enarthrosis, and in many of those by Arthrodia. The Director Muscles are wanting in those by Ginglymus, being there unnecessary. The Moderators are in general the same with those termed Antagonists, and the Want of their Action, is in many Cases supplied by the Weight of the Part to which they are fixed, or by the additional Weight or Resistance of some other Body.

The Action of the Muscles in General, or, to speak more properly, the Mechanism of this Action, consists chiefly in the Contraction or shortening of their fleshy Portion, by which the Extremities, of the Muscle are brought nearer to each other, and consequently the Parts are moved, to which these Extremities are fixed. It is, I say, the fleshy Portion alone which is shortened; the Tendons retain always the same Length, and only follow the Motions of the other Part, much in the same Manner, as in drawing a great Weight, by Ropes fixed to it, where the Arm alone is shortened, while the Ropes only follow that Motion.

The principal Phænomena of muscular Action, are these: The fleshy Portions appear harder and more swelled in the Time of Action, than of Inaction, as may be readily perceived by touching it in both States: The Hardness of this Swelling increases, by merely adding to the Weight or Resistance of the Part moved, though its Situation, does not continue to be changed.

In many Muscles, this Action may be determined to any Degree of Velocity and Space; that is, may

may be proportioned to the Velocity and Space of the Motion; may be increafed and diminifhed, accelerated, retarded, or ftopped; and may be made to ceafe in an Inftant.

During the Contraction of a Mufcle, its Fibres are bent through their whole Length, or formed into very fmall fine Folds, in alternately oppofite Directions, as may be plainly feen in Animals frefh killed, their Flefh while it remains warm, though the Blood has been let out and the Intrals removed. By opening living Animals, and alfo in great Wounds, the flefhy Fibres have been difcovered to grow pale during their Action, and to turn red again when at reft.

To thefe Phænomena, we muft likewife add, that where feveral Mufcles are fixed, to any moveable Part, they are all in a State of Contraction, in every Motion of that Part; but they are not all in the fame Degree of Action, becaufe the principal Movers act more than the Moderators and Directors, or collateral Mufcles, if any belong to the Part. This Co-opperation of Mufcles, is eafily perceived by touching them, when the Part they belong to, is moved with a confiderable Force. It muft however be remembered, that I expect the Moderators, or Antagonifts, when any Weight or Affiftance fupplies their Action.

Laftly, There are fome Motions, to which the Mufcles, commonly believed to produce them, contribute nothing at all, but which depend folely on the Relaxation of the Antagonifts to thefe Mufcles, or thofe that lie on the oppofite Side. This is feen evidently in fupporting the Body by one Hand refting on a low Table, the Joint of the Elbow, being in that State, fuffered to yield to the Weight of the Body, or bend fometimes flow, and fometimes faft; for if we feel with the other Hand the flexor and extenfor Mufcles of the Fore-

arm, the firſt will be found perfectly relaxed to determinate Degrees of Veloſity and Space, with the ſame Certainty, as they can be contracted.

The laſt Phænomena gave me room to conclude, that the Action of the Muſcles in general conſiſts as really in the Relaxation of the moving Fibres when contracted, as in the Contraction of them, when relaxed, whether the Action be performed ſucceſſively or inſtantaneouſly; and it was for this Reaſon, that when I began to ſpeak of the Action of the Muſcles, I did not abſolutely ſay, that it conſiſted in the Contraction of the fleſhy Portion, but only that it was principally owing thereto. I do not here ſpeak of thoſe Motions, that are out of our Power, and which we can determine only in Part; as thoſe of Reſpiration; or not at all, as that of the Heart.

The particular Mechaniſm, or immediate Cauſe of muſcular Action, has very much tortured the Brains of many Philoſophers.

The extreme Delicacy of the Texture of a moving Fibre, and a great Number of Phænomena, ſome of them very obvious, which have not been attended to, have hitherto prevented the Diſcovery of this Myſtery. Several Hypotheſes have been formed concerning the Structure of this Fibre, which, as already ſaid, has been ſuppoſed ſpongy, vaſcular, veſicular, contorted, elaſtic, &c. and concerning the Concurrence of different Fluids, with the ſuppoſed Structure of the Fibre Syſtems have even been founded wholly on the Spring or Elaſticity of the ſolid Parts of which a Muſcle is compoſed.

But by conſidering attentively the Phænomena already mentioned, eſpecially the firſt three concerning the Velocity, Space, and Duration of muſcular Action, all theſe Syſtems may be deſtroyed. For hitherto no Inſtance can be found either in natural

natural Effects, or in thoſe of Art, of any Exploſion, Fermentation, Ebullition, Injection, Inflation, Imbibition, Vibration, Elaſticity, &c. by which we can regulate and determine, to a given Degree, the Space, Velocity, and Duration of any artificial Motion; or by which we can put an End in an Inſtant of Time at our Pleaſure. It is therefore altogether to no Purpoſe, to amuſe ourſelves with what has been ſaid on this Subject: Another Method muſt be followed, which conſiſts in collecting and examining all the Phænomena, that can fall under our Obſervation.

Till ſome lucky Diſcovery is made, what can hitherto with the greateſt Certainty be gathered from the Structure, Confirmation, and Action of the Muſcles, is, that their Strength depends on the Number of their fleſhy Fibres, and the Extent of their Action on the Length of theſe Fibres.

For wherever Strength is more neceſſary than large Degrees of Motion, there we find the Fibres of Muſcles proportionably increaſed in Number, and that their Situation, in a narrow Compaſs, is artfully provided for, by the oblique Diſpoſition of them already mentioned. In like Manner, wherever there is more Occaſion, for a large Degree of Motion than for Strength, the fleſhy Fibres are of a proportionable Length. In a Word, the Strength of a Muſcle is as the Number of its fleſhy Fibres, and the Extent of its Motion, as the Length of theſe Fibres.

To underſtand the Uſes and Contrivance of each Muſcle in particular, we muſt conſider attentively its Place or Situation in general, its external Conformation, Inſertions, particular Situation, Direction, lateral Connexion, Relation and Compoſition of its Parts. We ought likewiſe to examine how the circumjacent Muſcles are diſpoſed

for producing simple Motions, and how those that are at a greater Distance, can produce combined and compound Motions.

It ought moreover to be observed that in some Subjects, the Muscles vary, some being wanting, and others added in different Manners, so that we ought to regulate ourselves by what happens most frequently, and universally, that we may not render the common Cases obscure, for the sake of a few that are extraordinary, and which ought to be considered in the same Light as we do the Instances of six Fingers, eleven Ribs, and other lusa naturæ of the like Lind.

Muscles fixed only to Bones act as so many Powers, applied to Levers;

By a Lever we understand a long inflexible Body, like a Rod or Bar, by the Help of which, we raise Weights and overcome Resistances, which it would be more difficult or imposible to do with the Hand alone.

A Lever, in order to act, is applied to the different Things, at three different Places of its Length, viz.

At one Place to the Weight or resisting Body; at a Second, by the Power with which it acts; and at a Third to a Fulcrum, which, with respect to the other two, ought to be immoveable; so that the whole Length of the Lever, is as it were divided by three Points; which may be termed the Point of Resistance, and that of Power.

These three Points may be disposed, in three different Manners; First the fixed Power may lie between the Point and the Weight, as when the Stone-cutters and Paviours, raise or move Stones with Iron Crows. Second, the Weight may lie between the Power and the Fulcrum, as when Masons move large Stones, by applying Crows to them, somewhere near the Middle. Third, The

Power

Power may lie between the Weight and Fulcrum, as when Braziers fcrape Copper, in order to tin it, by laying one End of the Scraper on their Shoulder, the other on the Metal, and holding the Middle in their Hands.

From thefe three Difpofitions, three different Kinds of Levers, have been eftablifhed. In the Firft, the Fulcrum, or fixed Point is in the Middle; in the Second, the Weight; and in the Third the Power.

In the Actions of Levers, the following Maxims are to be obferved as fo many general Rules.

The greater Diftance, of the Line of Direction, of the Power from the Fulcrum, lefs Force is neceffary to overcome the Refiftance.

The nearer that this Line of Direction is to the Fulcrum, more Force is neceffary to overcome the Refiftance, or raife the Weight.

When the Line of Direction of the Power paffes through the fixed Point; and confequently falls in with the Direction of the Lever, the Power can produce no Effect, WINSLOW.

* In order to the eafier Illuftration of this wonderful and important Property in the Fibres, I fhall give you, 1ft, An analytical View of the component Parts of a Mufcle. 2dly, I fhall fhew the true Caufe of Cohefion, Tenfion, and Elafticity in the animal Fibres. 3dly, I fhall make it appear, that every Fibre conftituting a Mufcle, is, in its ultimate Divifion, tubular, and not a Chain of Veficles or Bladders.

* This and the following Lecture, was wrote by the late ingenious Dr. BROWNE LANGRISH, Fellow of the Royal Society; and as the Croonean Lectures on the Mufcular Motion by Order of the Prefident and Council read before the Royal Society, 1747.

I thought it would not be difagreeable to the Reader to have them inferted at Length, being fo philofophically penned, on the moft probable Conjectures, as can be expected upon fo obfcure a Subject as this.

Bladders. And, Laſtly, I ſhall prove it more than probable, that muſcular Motion proceeds from the attractive Quality of the conſtituent Particles of every Fibre being increaſed and ſtrengthened by the Addition of ſome æthereal Matter flying out from the Extremities of the Nerves; and that this is inſtantly occaſioned by the Will, and ceaſes again as ſoon.

By a chemical Analyſis of a Muſcle diſſected from the Buttock of a lean Ox, which weighed exactly two Pounds Averdupois, I procured,

	Oz.	*Dr.*	*Gr.*
1. Lymph ———	24	14	15
2. Volatile Salt —	1	4	25
3. Oil ——— —	2	6	20
4. Caput mortuum —	2	9	5
5. Loſt in Diſtillation, which I preſume was moſtly mere Air	—	12	16
	32	00	00

There being no Averdupois Weights in the Shops, leſs than Quarters of Ounces, I ordered ſome to be made of a Drachm, and others of two Drachms. The Drachm weighed 27 Grains; ſo that, by caſting up the Grains into Drachms, and the Drachms into Ounces, we have the exact Weight of each of the above conſtituent Principles according to the Weight they were firſt of all weighed with.

It may be proper alſo to obſerve, that the Apparatus I made uſe of in this Proceſs, was the ſame which I communicated a Deſcription of to the Royal Society ſome time ago, and which is ſince publiſhed in the Philoſophical Tranſactions, N° 475; except that the Retort I now uſed was made of Copper, in order that I might remove it from the Sand-

Heat

Heat into the actual Fire, without unluting any Part of the Apparatus, when no more Matter would arise by means of the Sand-Heat.

By this Method I could increase the Fire till the Bottom of the Retort was red-hot, without any Danger of breaking my Recipients; a Contrivance which may be useful in many chemical Processes.

From the above-mentioned Experiment we have evident Proof of the Proportions and Qualities of the several Principles, or constitutive Parts of the muscular Fibres; and let no one be surprised that watery or phlegmatic Principle abounds so much as to be nearly $\frac{13}{16}$ Parts of the whole Mass, since we know that dried Bones, and many other Things as unpromising, affords half their Weight of Water.

That the Particles of Water are endued with a strongly attracting Power, and are highly serviceable as a Band of Unions in the Formation and Growth of Animals and Vegetables, but also in our own manual Operations, such as making several Sorts of Glue, Pastes, Bricks, and such like, where the watery Particles prove a very durable and powerful Copula, and are not to be all of them separated again, even by a very intense Fire: Water is to be regenerated from Bricks and Tiles after they have been burnt in a Kiln.

The driest Wood, Part of a Mahogony-Table, which had stood by the Fire many Years, being rasped and put over the Fire in a Copper Retort, afforded a considerable Quantity of Water.

In short, take away the Water from the most solid animal and vegetable Bodies, and they immediately become mere Dust.

I don't apprehend that this considerable Quantity of Water, which is to be procured from such solid Substances as Bricks, Wood, or even from the muscular Fibres, remains in distinct Drops or Spherules,

Spherules, whilst it is a Part of such solid Substances; but I conceive that the Minima, or primary solid Particles of Water may be attracted by, and actually joined with, the earthy, saline, and other component Particles, so as to compose the several Degrees of Hardness, according to their respective Proportions and Qualities; and when these several constituent Principles are disunited again, by the Power of Fire, or by the Length of Time, they rise up into the Air, or into the Recipient, according to their Divisibility and Levity; first Water, next Salt, then Oil.

Nature seems to delight in Transmutations. Many Kinds of Fluids are easily converted into dense Bodies. We all know how soon Water is capable of being turned into a very solid friable Stone, by the Power of Cold. Mercury also is easily turned into a hard brittle Metal; and both these return to their former State of Fluidity by means of Heat. And a Solution of Copper in Spirit of Nitre being poured on Oil of Tartar, both Liquids instantly become Verdigrease in a dry Powder.

From what has been said we may observe, that Water, or the aqueous Particles not only make up much the greatest Part of the muscular Fibres, but, by mutually attracting, and being attracted by the other component Particles, they greatly contribute towards their Cohesion and Elasticity; for a fluid Particle will be fixed, and become a Part of a Sold, as soon as there is an attractive Force sufficient to effect its Cohesion with other solid Parts, though it returns to its former State of Fluidity upon the Analysis of the compound Body.

I would not by this be understood as if I designed to exclude the other Principles from their Participations which they give to the true Degree of Firmness and Elasticity in the Fibres; the saline, sulphureous, and earthy Parts are all endued with a strong-

ly

ly attracting Power; and when brought into Contact with each other, or with the watery and aereal Particles, they give Firmneſs and Solitude to the Compoſition.

Water ſeems to be the Gluten by which the other Principles are wrought up. Too much Water in the Compoſition renders the Fibres ſoft and lax; as in Children, and anaſarcous People. Too little Moiſture occaſions a ſtiff, rigid Fibre; as in old Age. There is a certain Degree of Texture and Coheſion neceſſary towards muſcular Motion in its greateſt Strength.

I have ſhewn in a former Treatiſe *, that Air is very inſtrumental in fixing and uniting the other Principles which conſtitute an animal Fibre; for in the moſt ſolid Parts of the Body, where the Coheſion is ſtrongeſt, we find great Plenty of Air. That the airy Particles are capable of being united, and fixed to ſolid Bodies, and by that means may be eſteemed a Part of their Compoſition, we have many evident Proofs in Dr. HALES's Analyſis of the Air; and that thoſe Particles do in their fixed State ſtrongly attract the other component Particles is evident, it being well known, that the moſt ſtrongly repelling and elaſtic Particles when in a ſeparate State, are the moſt ſtrongly attracting, when fixed to other Bodies.

Now, according to Dr. HALES, ſince a much greater Proportion of Air is found in the ſolid than in the fluid Parts of Bodies; may we not with good Reaſon conclude, that is very inſtrumental, as a Band of Union in thoſe Bodies; thoſe Particles (as Sir ISAAC NEWTON obſerves †) receding from one another with the greateſt repulſive Force, and being moſt difficultly brought together, which upon

* Modern Theory of Phyſic, p. 56. † Opt. Qu. 31.

Contract

Contract cohere most strongly? And if the Attraction or Cohesion of an unlastic Air Particle be proportionable to its repulsive Force in an elastic State, then since its elastic Force is found to be vastly great, so great also must be that of its Cohesion. Let us add to this, that the Air generated from the fleshy Fibres, in the Experiment above-mentioned, was not separated without great Violence; for it did not rise in any Quantity, till the Clouds did, which contained and brought over the Salt and Oil: Whence it is evident that the aereal Particles are firmly fixed, and consequently are very instrumental in the Union of the other constituent Principles.

Sir ISAAC NEWTON * thinks that not only Water and Air are convertible into dense Bodies, but that even Light may become a Part of gross Bodies, and that they may receive much of their Activity from the Particles of Light which enter their Composition. It is the Opinion also of Monf. HOMBERG, that Light or Fire is a Part of the Composition of all Things; though in the Analysis of Bodies it is always lost, escaping the Skill of the Artist, and passing through the closest Vessels.

These then being the component Parts of the muscular Fibres, our next Task is to shew the Cause of their Tension and Elasticity.

That all the muscular Fibres of the Body are in a State of Tension, during Health, is manifest from every Incision made across them, when the two Segments of the Muscle so divided, retire, one to its Insertion, and the other to its Origination; that is, every Fibre is always stretched out beyond its natural State of Rest or Quiescence, so

* Opt. Qu. 30.

that both Ends of it retract a confiderable Diftance after being cut afunder. Now there are two Things which feem to be principally concerned in this Affair ; viz. the Impulfe and Preffure of the circulating Fluids, always diftracting the Fibres, and a conftant Nifus or Endeavour in the conftituent Particles of the Fibres to run clofer together, when fo deftined, by means of their mutual Attraction towards each other.

The Equilibration which is ever preferved between the antagonift Mufcles, in a healthy State, unlefs when the Will directs it otherwife, arifes from this Vis Reftitutionis ; which being ftronger or weaker, according to the Degrees of Tenfion, and the Degrees of Tenfion depending upon the Velocity and Quantity of Fluids circulating through every Fibre ; it follows, that as long as the Fluids have the fame free Accefs to every voluntary Mufcle, fo long will the Equilibrium be maintained.

When any faline Liquor (fays he) is evaporated to a Cuticle, and let cool, the Salt concretes in regular Figures ; which argues, that the Particles of the Salt, before they concreted, floated in the Liquor, at equal Diftances, in Rank and File ; and by Confequence, that they acted upon one another by fome Power, which at equal Diftances is equal, at unequal Diftances is unequal : For, by fuch a Power, they will range themfelves uniformly, and without it they will float irregularly. And fince the Particles of Iceland Chryftal act all the fame Way upon the Rays of Light, for caufing the unufual Refraction, may it not be fuppofed, that in the Formation of this Chryftal, the Particles not only ranged themfelves in Rank and File for concreting in regular Figures, but alfo, by fome kind of polar Virtue, turned their homogeneal Sides the fame Way ?

And

And again, we are taught by the ſame great Man, that Fire is the moſt ſimple of all known Bodies, and conſequently the moſt immutable; that each Ray of Fire or Light has Sides differently affected, and which have different Properties; and that Iceland Chryſtal is found to attract a Corpuſcle of Fire, if one of its Sides be turned towards the Chryſtal, and repel it, if the other be; for one and the ſame Ray is here refracted ſometimes after the uſual, and ſometimes after the unuſual manner, according to the Poſition which its Sides have to the Chryſtal; and ſince the Chryſtal, by this Diſpoſition or Virtue, does not act upon the Rays, unleſs when one of their Sides of unuſual Refraction looks towards that Coaſt, this argues a Virtue or Diſpoſition in thoſe Sides of the Rays, which anſwers to, and ſympathiſes with, that Virtue or Diſpoſition of the Chryſtal, as the Poles of two Magnets anſwer to one another.

We are fully perſuaded, that, in the Chryſtalliſation of Salts, they could not ſo regularly and conſtantly preſerve their peculiar Shapes, Forms, and Figures, if every Particle of them had not its determinate Poles: For granting that the component Particles of each kind of Salt, have a peculiar Shape and Size, different from any other kind of Salt, yet if they had a Power of uniting with each other indifferently, at their Tops, Sides, and Bottoms, one would think they could not always coaleſce into Chryſtals of the ſame regular Figure: But if the conſtituent Particles of every kind of Salt have their determinate Poles, then they cannot poſſibly unite with each other, but when their Poles ſquare with one another, conſequently they will always fly together, and be joined at ſuch Points, only where their correſponding Poles are; which muſt of courſe conſtantly

produce

produce the fame regular Form and Figure in every Aggregate of fuch particular faline Particles.

Hence it is, that Salt Ammoniac fo elegantly imitates the Branches of a Tree; Salt of Hartfhorn a Quiver of Arrows; Salt of Tin fhoots into Lines like little Needles, which fpread themfelves every Way from a Point, as a Centre, fo as to reprefent a Star, &c. Now can it be imagined that thefe, or any other kind of Salts, would immutably and perpetually coalefce into Chryftals of the fame regular Figure and Shape from any other Principle?

Since therefore we have fo much Reafon to believe that Salts of all kinds, and even the Rays of Light are endued with a polar Virtue, that is, every Corpufcle attracts on one of its Sides, and repels on the other; and fince it is well known Axiom, that Nature is ever frugal in Principles, I think it not at all unphilofophical, or contrary to any of the known Laws of Nature, to believe that every Particle of Matter in the World is endued with an attractive and repulfive Property.

Thus then, if the conftituent Corpufcles of the mufcular Fibres are formed together according to this Law, if they are all united at particular Points correfponding to their attractive Virtue, it follows, that wherever a mufcular Fibre is ftretched out to the leaft Degree of Tenfion, fome of its Particles will touch each other in fewer Points; whilft others may poffibly be difunited and removed from each other, though perhaps to inconceivable fmall Diftances: Hence there will be a conftant Nifus in the feparated Particles to get together again; and this Vis Reftitutionis will be ftronger or weaker, according to the Number of Corpufcles fo disjoined, and their attractive Virtue.

If the Power of circulating Fluids (and I think it cannot be denied) be fufficient, from the firft Be-

ginning of the Circulation of the Fœtus, and so on as long as Life continues, to diftend the Fibres beyond the Size they would otherwife be of, by reafon of their corpufcular Attraction; this diftractile Power muft always be the Occafion of fome Degree of Tenfion in them: And if, upon the Removal of this Tenfion, the component Particles have a Property of running clofer together, and contracting the Fibres in their Length, by the means above mentioned, this muft be the true Caufe of Elafticity in the Fibres.

Hence therefore it follows, that fince the Fibres are always in a State of Diftraction, by the Quantity and Momentum of the circulating Fluids, and as they are ever endeavouring to fhorten themfelves, by means of their corpufcular Attraction, their Elafticity muft depend upon Tenfion; for the Fibres could have no Power to retract, or abbreviate their Length, unlefs they were extended beforehand by fome certain Force.

It is not a fufficient Objection againft this Scheme to fay, that if we depend upon what is vifible, we fhall never fee the dry folid Fibres, or Particles of any folid Body, once divided or drawn out of Contact, coalefce or unite again, or recover the clofe Contacts they had before; without fome fluid Medium fuperadded.

'Tis true, when a vifible Crack or Flaw happens in any dry, hard, folid Body, fuch as a Steel-Spring, or a dry, rigid, wooden Bow, the Rupture will always continue, by reafon the fevered Particles cannot be brought again into the Sphere of each other's Attraction without the Intervention of fome Medium; but then it does not follow from hence, that fuch a Spring or Bow cannot be bent at all without breaking; or that the conftituent Particles, which muft neceffarily be difplaced by fuch a diftending Power, do not fly together again by their attractive

attractive Virtue, when removed only to ſuch minute Diſtances.

The Minima, or primary Atoms of all Bodies are non-elaſtic, as being perfectly hard, ſolid, and inſeparable; and therefore Elaſticity muſt proceed from the Aggregate, or Compoſition of ſuch Atoms, which, by being capable of changing their Situations, according to the impreſſed Force, and being endued with a powerful attracting Virtue, they inſtantly reſume their former Poſitions, when left to themſelves to obey thoſe Laws which the great Creator hath impreſſed upon them. As for Inſtance: Whilſt a common Steel Spring, or any ſuch elaſtic Body, is not extended or bent, we preſume every individual Particle of it to be at Reſt; that is, they are all ſituated, in regard to each other, according to their Poles, and embrace one another by their common Principle of Attraction; but no ſooner is ſuch a Spring bent, by ſome impreſſed Force, but many of its Particles on the convex Side, muſt of courſe touch in fewer Points, or perhaps be diſunited from each other, though to the moſt minute Diſtances that can poſſibly be; whilſt other Particles, on the cancave Side of the Spring, muſt neceſſarily ſlip upon, or be crouded over one another. Hence it will follow, that if thoſe Particles which are ſeparated from each other, or touch one another in fewer Points than uſual, are yet ſo near each other as to be within their Sphere of Attraction, and not at all, or very little altered in regard to their Poles, they will conſequently attract each other very ſtrongly, and fly together again, as ſoon the as impreſſed Force is removed; whereas it is no unreaſonable Conjecture to ſuppoſe, that thoſe Particles on the concave Side of the Spring, which are compreſſed, and as it were rumpled over one another, may be ſo much altered from their former Poſitions, that their Poles do

not now anſwer to each other; and if not, they will repel one another, according to their reſpective Powers, till they have attained their former Situations, or, in other Words, till the Spring has recovered its former Shape.

The ſame Principles of Attraction and Repulſion are the Cauſe of Reſtitution or Elaſticity in all other kind of Bodies. When a muſcular Fibre is ſtretched out longer than uſual, it is moſt certain that ſome of its component Particles muſt ſlip upon or by one another, or removed at exceeding ſmall Diſtances from each other; ſo that if the impreſſed Force be too violent, if the Tenſion be carried ſo far as to diſunit a great Number of the component Particles beyond their Sphere of Attraction, the Fibre will continue to grow weaker and weaker till it breaks: But it is as evident, on the other Side, that when a ſtretched-out Fibre does not break, but retracts itſelf into its former Shape and Dimenſions upon the Removal of the extending Power, the Particles which were diſplaced return again to their proper Poſitions, merely by the means of their attractive Virtue.

Now all this being ſo agreeable to thoſe Laws of Nature which that divine Man Sir Isaac Newton has diſcovered to us, I think we have good Reaſon to conclude it to be the true Cauſe of Elaſticity in the animal Fibres.

The Elaſticity in the Air indeed, or in Water agitated by Fire, or in all the Exhalations, and Air, ſtand at a Diſtance from one another, and endeavour to recede as far from one another as the Preſſure of the incumbent Atmoſphere will admit them. No Power yet known is able to compreſs the Air-Particles within the Sphere of their elaſtic Property; and yet ſingle primary Particles of Air are continually attracted by other Bodies, and conſolidated with them, till by the Action of Fire, or

or Fermentation, they are separated again, and restored to their repulsive State.

Hence we may observe, that Elasticity, in different kinds of Things, or in Matter differently modified, may arise from two several Causes, viz. Attraction and Repulsion; and perhaps, in many Instances, from the Influence of both at one and the same time.

Whenever any kind of Matter is actuated by Fire, by Fermentation, or dissolved by any Menstrum, so as to throw off its Particles in subtle Vapour, there will be a constant Endeavour in those Particles to recede further from each other; so that the more they are confined, or compressed, the greater will be the elastic Power: Whereas in solid Bodies, this Property of Elasticity proceeds chiefly from Attraction, or a Nisus in the component Particles to fly back, or run into close Contracts again, whenever they happen to be stretched out, or bent, so as to touch each other in fewer Points.

From what has been said, we may deduce the following Corollary, viz. That whenever Elasticity proceeds from the Principle of Repulsion, as it does in Air, Vapours, &c. some Compression is necessary, in order to force the elastic Matter into a narrower Compass than it would otherwise possess; but when it arises from Attraction, as in the muscular Fibres, and all solid Bodies, some distractile Force is requisite to disjoin the component Particles from their usual Contracts, before it can exert its Power; and perhaps, for want of attending to this Difference, so many various Opinions may have risen concerning the Cause of Elasticity.

In my next Lecture, I shall consider the Shape of the muscular Fibres, and the Cause of muscular Action.

LECTURE XV.

Of the MUSCULAR ACTIONS.

IN my former Lecture, I endeavoured to explore the ſeveral conſtituent Principles of the muſcular Fibres, and to ſhew the true Cauſe of their Coheſion, Tenſion, and Elaſticity. In this, I hope, I ſhall make it appear, 1ſt, That every Fibre conſtituting a Muſcle is tubular, and of a cylindrical Shape, or very nearly ſuch; and not a String, or Chain of Bladders, according to an Hypotheſis which has been too long and too generally received. 2dly, That the corpuſcular Attraction between the component Particles of the Fibres is ſo far increaſed and ſtrengthened by the Influence of the nervous Æther, which is always at the Command of the Will, as to purſe up and ſhorten every Fibre in its Length, whereby an Intumeſcence ariſes in the Middle of the Muſcle, though it is contracted in its other Dimenſions, ſo as, in the whole, to poſſeſs leſs Room.

Being favoured with the Uſe of a moſt excellent Microſcope, I made the following Experiments.

1ſt, I divided ſome Fibres as minutely as I poſſibly could, from the Heart of an Ox, from a Part of the Diaphragm, from the intercoſtal Muſcles, and

* Reab before the Royal Society March 26, 1747.

from

from a Rump of Beef; all which were boiled to ſuch a Degree of Tenderneſs, that we ſeparated ſome Fibres with the Point of a Needle, which were not viſible till placed under a Microſcope, and even then they did not appear bigger than Hairs though others, which looked like Hairs to the naked Eye, were magnified to the Size of Wheat-Straws. All theſe ſeemed to be Faſciculi of continued Tubes, as far as we could view them, without any Partitions or Cells.

2dly, Upon rendering a Muſcle, which was taken from a Knuckle of Veal, and boiled for four or five Hours ſeveral of the tranſverſe, as well as longitudinal Fibres appeared very diſtinctly; which being placed under the Microſcope, and having a ſtrong focal Light caſt upon them by means of a Florence Flaſk fill'd with Water, they ſeemed to be ſhrunk up, either by being boiled ſo long, or by being expoſed to the Air, ſo that their Surfaces ſeemed to be unequal and corrugated; which is what Lewenhoek * ſays deceived him at firſt, ſo as to make him think theſe Corrugations were ſo many Veſicles or Cells; but he ſoon diſcovered his Miſtake. In ſome of the Fibres I could plainly diſcern a dark Liſt running in the Centre, from one End to the other; but what it was, I could not diſcover.

3dly, Having obſerved the muſcular Fibres in the Leg of a Sea-Crab to divide very eaſily and diſtinctly from one End of the Muſcle to the other; we placed a great many of them under the Microſcope, but could not diſcern any thing like Partitions or Cells.

In ſhort, Lewenhoek † aſſures us, that the minuteſt Fibres that are viſible to the naked

* Anatom. & Contempl. p. 43. † Phil. Tranſ. No 367.

Eye appear through a good Microſcope to be inveſted with a Membrane, which includes winthin it not one ſimple Body, but a Bundle of ſtill finer Fibres, the laſt, or ſmalleſt Order of which he thinks to be ſimple Tubuli.

This perhaps is as good Authority as we can have from the Aſſiſtance of Microſcopes; but if we may be allowed to deduce our Arguments from the Analogy which the muſcular Fibres bear to ſome other Parts of the Body, whoſe Shapes we are well acquainted with, the Reaſonableneſs of this Opinion may appear yet ſtronger.

All Anatomiſts agree, that the muſcular Fibres have their Riſe from the Extremities of the Nerves and ſanguiferous Veſſels; every Fibre being ſupplied by a Branch of a Nerve, and an Artery, and having alſo a Vein ariſing from it.

That the nervous Capillamenta are Cylinders is not denied by any one that I know of; and though the Arteries have been for a great while thought to be conical, yet the ingenious Dr. JOHN STEPHENSON, * Fellow of the Royal College of Phyſicians at Edinburgh, hath evidently demonſtrated the whole arterial Syſtem to be Cylinders, frequently divided and ſubdivided, ſtill terminating in Numbers of Cylinders, the Aggregate of which is always of greater Capacity than the Trunk or larger Cylinder before the Ramification.

May we not therefore very reaſonably believe, from the Simplicity and Uniformity in all the Operations of Nature, that the muſcular Fibres partake of the ſame Figure with thoſe from whence they have their Riſe; eſpecially when ſuch a Shape (as will appear in the Sequel) is more proper for all the Functions of a Muſcle than any other whatſoever?

* Medical Eſſays, Vol. vi.

I do not mean by this, that every Fibre of every Muscle is a perfect and regular Cylinder from one End to the other; many of them may be thicker in their Tunics and larger in their Bores about the Middle, than towards each End, similar to the Shape of the Muscle; but what I think the most reasonable Opinion is, that the smallest Fibrillæ are Tubuli not divided into an infinite Number of Cells or Vesicles.

The longitudinal, red, fleshy Fibres seem indeed to be contorted and bound about in many Places, with white, spiral, and transverse Ramifications of the Nerves; but I can see no Reason to believe that these nervous Filaments divide the longitudinal fleshy Fibres into several Apartments or Cells; I rather think that they only dip into the Cavities of the Fibres, in order to convey into them the æthereal Medium, which is contained in the Nerves.

Before the Laws of Nature, and the Animal Oeconomy were so well known as they are now, I do not wonder that the vesicular Opinion was thought a reasonable one, till it came to be examined by strict Rules and Experiments. The common Experiment of raising Weights by blowing up Bladders might seem, at first Sight, a very feasible Way of explaining muscular Motion; and without Doubt this first of all gave Birth to the vesicular Hypothesis.

But the Fallacy of this Experiment was not discovered for want of attending to the Difference between Bladders which have been already blown up and dried, and such as are recent and supple.

If a String of dry Bladders, which have been once distended as far as they could bear without bursting, and are now again squeezed close, and stretched out only in their Length, by means of a Weight hung at their Bottom; I say, if such a

String

String of Bladders be blown up, it will undoubtedly diftend their tranfverfe Diameters fo as to raife up the Weight: But in all tender yielding Vefícles, fuch as the mufcular Fibres moft certainly are, in their laft, or fmalleft Order, it is well known, that if they were to be inflated with Air, or any fuch-like Matter, it would diftend them in every Direction alike; they would grow longer as well as wider. Hence it follows, that if the abovementioned Experiment was to be made with Bladders juft as they are taken out of animal Bodies, it would not anfwer the Purpofe, as is evident from blowing up thofe of Calves, Hogs, &c.

The mufcular Fibres, it is true, are always in a State of Tenfion, but then this Tenfion is very far from being to their utmoft Stretch; fo that, were they to be inflated in the manner above-mentioned, every Mufcle would neceffarily increafe in Length as well as Breadth.

Another infuperable Difficulty belonging to the veficular Hypothefis, is how to blow up a Bladder open at both Ends; which every Veficle is fuppofed to be, by having a free Communication with the Blood-veffels.

Having therefore fo much Reafon to conclude, that the mufcular Fibres, in their ultimate Divifions, are not cellular but tubular, let us proceed to fhew the Manner and Caufe of their Contraction.

A Muscle in its Action very evidently grows less in Bulk.

This Propofition is clearly demonftrated by that famous Experiment communicated to the Royal Society, by Dr. Goddard* in the Year 1669, where

* Vid. Regifter of the Royal Society, Vol. IV. p. 95.

where, putting a Man's Arm into a Glafs Cylinder full of Water, the Water always funk when the Mufcles of the Arm were contracted, and rife again to the firft Standard when they were relaxed. This we think may be looked upon as an Experimentum Crucis; whereas, if every Fibre was a Chain of Bladders, whofe Contraction in Length arofe from their Inflation in Breadth, all the World knows there would be a fenfible Swell of the whole Arm upon mufcular Action.

There are ftill other Difficulties attending the veficular Hypothefis. If the animal Spirits are fuppofed to inflate the Cavities of the mufcular Fibres merely by a propulfive Force, like unto the Steam of boiling Water working in the Engine to raife Water by Fire, it ought to be proved from whence fo ftrong an Impulfe fhould arife; and alfo how the Nerves, which are the Conduits thro' which this flatulent Matter muft be conveyed, fhould lie fo loofe and unelaftic; it being evident from all Experience, that if fuch an elaftic flatulent Vapour was to fly thro' the whole Length of the Nerves, with an Energy fufficient to give a Man a Power of lifting up great Weights, the Nerves muft be ftretched out in Proportion, and confequently would be very tenfe and elaftic.

Thofe who fuppofe the Inflation of the Mufcles to arife from a fermentative Motion in the Fluids, ought to prove, by a proper Number of Experiments, that there are Juices exifting in the Body capable of fuch fudden and violent Rarefactions or Explofions, upon mixing with each other; and if this poffibly could be done, the Diminution of the Bulk of the Mufcles in Action, would overturn all their Scheme.

Hence it is evident that the veficular Hypothefis ought to be entirely rejected, as being repugnant to the Laws of Matter, and to the Phænomena of the Mufcles.

By

By undoubted Experiments we are convinced, that the Intumeſcence of a Muſcle, when it acts, ariſes merely from a Change made in its Figure; that is, as it ſhortens in Length, the Belly grows thicker, and yet the Bulk in general is diminiſhed. Let us therefore inquire after the Agents which are capable of producing ſuch ſurpriſing Phænomena, and at the ſame time ſhall be conſiſtent with every other Operation in the Animal Oeconomy.

From what has been ſaid it appears, that Contraction, or muſcular Action, does not depend upon any Fluid dilating or diſtending the Fibres; but, on the contrary, they ſhrink up and grow leſs. The inſtantaneous Alternations from Conſtriction to Dilatation, and vice verſa, manifeſtly diſcover that muſcular Motion cannot be cauſed by ſuch Juices as the Blood, Lymph, and ſuch-like; but it muſt be from ſome more ſuitable ætherial Matter, which may be mixed with the Blood in general, and ſecreted from it by the Glands of the Brain.

Let us but carefully conſider the exquiſite Apparatus of the Brain, the Quantity of Blood it receives, the infinite Number of its excretory Ducts, and the great Diviſibility and Subtilty of Matter, and we ſhall find great Reaſon to conclude that there is a moſt ſubtil, æthereal, volatile Fluid, of great Force and Elaſticity, perpetually ſecreted from the Blood, by the Glands of the Brain, and continually flying into the Nerves, for the Uſes of muſcular Motion, and many other great Purpoſes of the Animal Oeconomy.

The delicate Texture of the Nerves, as well as that of the Brain, implies that the Fluid they convey to the Muſcles muſt be exquiſitely fine. Indeed when a Nerve is wounded, there flows from it a ſweet, ſoft, clammy, balſamic Juice, which no doubt is carried, at all other times, by the eva-

refcent Nerves to their ultimate Divifions, in order to nourifh and preferve the moft minute Fibrillæ, and all their Expanfions; and this may properly be called Succus nutritius of the Nerves. But I cannot conceive that this vifible Juice has any thing to do with the immediate Caufe of voluntary Motion; for fo vifcous a Matter could never admit of fuch fudden Viciffitudes, as are in mufcular Action, if it was capable of performing it in other Refpects.

There are Abundance of Confiderations which evince the Exiftence of fome fubtle Spirit in the Nerves, much finer than to be the Object of our Senfes. We have no Proof, either from Experiment or Reafon, of any other inftrumental or phyfical Caufe of Senfe or Motion, but this animal Æther which is elaborated from the Blood.

The learned Dr. MEAD * thinks no Regard ought to be had to the immechanical Notions of thofe Authors, who imagine that there is no fuch thing as a nervous Fluid in an animal Body; and that mufcular Motion and Senfation are performed only by the Vibrations of the Fibres of the Nerves, without the Intervention of any fpirituous Fluid.

The furprifing Difcoveries which have been made of late Years, by a Variety of Experiments upon Electricity, do in fome meafure give us an Idea of the great Subtilty and Velocity of the nervous Fluid. I have been informed by the ingenious Mr. WATSON, a worthy Member of the Royal Society, that the Swiftnefs of the electrical Effluvia is prodigious; that one Stroke of his Hand down the Tube, when well electrified, was felt as foon as his Hand could be at the Bottom of the Tube, through five Men ftanding upon electrical

* Introduction to his Effays on Poifons, Edit. iii.

Cakes,

Cakes, and communicating with each other by a Cane, Sword, or any other Non-electric.

Hence it follows, that if a Tube could be always excited, and was always to be applied to the End of a proper Cord or String; the electric Matter, which is excited by Friction between the Hand and Tube, would ever be ready to exert its attractive Influence on Leaf-Gold, and ſuch like Things, when placed within a due Diſtance of the End of the String; and perhaps this may be very ſimilar to the Motion and Action of the nervous Æther.

Thus much being premiſed, and it being taken for granted, that we have an æthereal Medium in the Brain, Spinal Marrow, and all the Capillamenta of the Nerves, ever ready to be conveyed into the muſcular Fibres, by the Power of the Will, and which Medium conſiſting of the moſt refined Matter in Nature; it follows, that the Motion of this nervous Æther may be as quick as Lightning, and alſo its attractive Power muſt be exceeding ſtrong, by virtue of its vaſt Degree of Subtilty; as is evident from what Sir Isaac Newton* has calculated concerning the Rays of Light.

From theſe Obſervations therefore, and from what has been ſaid above, concerning the Coheſion and Elaſticity of the animal Fibres, I think we have great Reaſon to conclude, that muſcular Motion does proceed from the Influence which the nervous Æther has upon the component Particles of the muſcular Fibres themſelves, by inſtantly increaſing their attractive Virtue towards each, ſo as to make them run cloſer together, or, as it were, up into Heaps, as long as ſuch an additional attractive Medium is in the Fibres.

* Opt. Qu. 23, 24.

If

If we look back and confider the Nature of the Vis Reftitutionis, or Elafticity in the mufcular Fibres, we fhall find, that the Property only wants to be increafed, in order to overcome the diftractile Force of the circulating Fluids, and the Refiftance of the antagonift Mufcles: Whence it follows, that if fuch a Power was to be increafed in one Set of Mufcles, and not in their Antagonifts, thofe Mufcles, whofe elaftic or retracting Power was increafed, would be abbreviated in their Length, whilft the others would be extended and lengthened.

When any Mufcle is freed from the Power of its Antagonift by a Section, &c. it immediately contracts, and is not to be extended again by the Power of the Will. Whence it has been faid, that Contraction is the proper State of the Mufcles, and to which they always tend: But if we narrowly infpect into this Affair, we fhall find, that, when a Mufcle is contracted in this manner, it is no farther fo than the elaftic reftitutive Property in the Fibres is concerned. We do not find that fuch a Mufcle is indurated, or its Belly fwoln like unto what it is in voluntary Action; for here being no Influx of the nervous Æther to increafe the corpufcular Attraction, the Mufcle is fhortened only by the inherent mutual Attraction between the conftituent Particles of its Fibres, without any Matter being fuperadded. This kind of contraction therefore is evidently the State to which the elaftic Fibres tends by a continual Conatus in the component Particles to accede towards each other without the Affiftance of the nervous Æther; fo that this natural Vis Motrix in the mufcular Fibres is no more than what we mean by their Elafticity, or reftitutive Property: It feems, however, to be demonftrated from hence, that mufcular Action and Elafticity in the Fibres,

proceed

proceed from the fame Caufe in different Degrees; viz. from corpufcular Attraction.

Let us now endeavour to corroborate thefe Arguments by fome fuitable Obfervations.

1ft, From what has been faid, we may conceive more readily, than we know how to exprefs, that the Will has a Power to direct the æthereal Medium contained in the Nerves, to any of the voluntary Mufcles, with fuch a Degree of Celerity as it pleafes; and to ftop the Influx as fuddenly.

2dly, It is evident that the Tunics, or carnous Subftance of every Fibre, muft neceffarily increafe in its Thicknefs, when it abates in its Length; and what Power can produce this Effect, but fuch a one as increafes the mutual Attraction between the conftituent Particles?

3dly, Hence appears the Reafon, why the Middle of a Mufcle fwells during its Contraction, notwithftanding its Dimenfion in general is diminifhed; for as the component Particles of each Fibre are more loofely connected about the Middle than towards its Extremities, which are generally tendinous, it is natural to fuppofe that the chief Action is between them; that is, when a Fibre grows fhorter, fuch of its Particles which are moft at Liberty run nearer together, and as the Motion of all Bodies is ever in proportion to the Impulfe they receive, and the Refiftance they meet with, fo when the conftituent Particles of the mufcular Fibres are drawn into a fhorter Compafs, by the means above-mentioned the Middle of the Fibres muft fwell either internally or externally, or both, according to the Refiftances they meet with.

And laftly, Since the Tunics of the mufcular Fibres do moft certainly grow thicker as they contract in their Length, and yet the external Surface of the Mufcle in general is diminifhed; it manifeftly follows that their Cavities muft grow lefs, and

and their contained Fluids muft be preffed out, in proportion to the Contraction of the Mufcle.

This appears upon Blood-letting, when fqueezing any thing hard in the Hand will make the Blood fly out with a greater Velocity, and thereby form a larger Parabola.

This alfo accounts clearly for the Induration and Palenefs of a Mufcle during its Action.

And again, it follows hence, that in the Action of the Mufcles there is an alternate Diaftole and Syftole perfectly analogous to the Action of the Heart, which greatly contributes towards pufhing on the Blood in the Veins.

The Mufcles being contracted merely by the Influence of the nervous Æther, and the Influx of the Æther being ftopt by withdrawing the Impetus given to it by the Power of the Will; the Reafon and Manner of their Relaxation will eafily appear. For fince the nervous Fluid is extremely fubtile, that Portion of it which is thrown into the mufcular Fibres, acts but for a Moment, or the leaft Space of Time, fo quick is it in its Motions, and fo penetrating in its Nature; and no fooner is the Vigour of the Attraction over, but the Tenfion of the antagonift Mufcles, and the Impulfe of the Blood will extend them again.

Whoever duly confiders the well known Effects of magnetical and electrical Effluvia will be at no lofs to conceive the inftantaneous Influence which the nervous Æther has upon the mufcular Fibres.

It muft be confeffed indeed, that thefe Intima Naturæ, or fecret Operations in the Animal Oeconomy are all fkreened from our Knowledge, the Agents being too fubtle ever to become the Objects of our Senfes, though ever fo well affifted; fo that we can only form fuch collateral Proofs, or from fuch Data as we are pretty fure are true. As for Inftance; the Influence which the Soul has

upon the æthereal Medium in the Nerves muſt be by Impulſe; for though our finite Capacities are not able to comprehend the Nature of immaterial Impulſe; yet nothing is more certain than that the moſt ſubtil Matter in the Univerſe cannot be moved without ſome impreſſed Force.

That the Will does exert itſelf after this manner, is in a good meaſure proved by Dr. Stuars's * Experiment upon a Frog, where a proper Impulſe being given to the Medulla ſpinalis did excite Motion in the voluntary Muſcles, though the Head was ſevered from the Body.

Hence alſo it appears, that the Nerves are always replete with a ſubtil Fluid capable of contracting the Muſcles, or otherwiſe ſuch as an Impulſe on the Beginning of the Nerves, could not have excited Motion after the Head was cut off.

And again, common Experience aſſures us, that tho' the Nerves are always replete with an ætherial Medium, yet this Medium, in a State of Health, never flies out at their Extremities, into the muſcular Fibres, without ſome Impulſe by the Direction of the Will: Whenever it appears to do ſo, Convulſions and Cramps are the natural Conſequences.

It may perhaps ſeem ſtrange to ſome, that I have not all this while taken any Notice of the Blood, as an Agent in muſcular Motion; ſince it has ever been reckoned ſome way neceſſary towards it. But notwithſtanding this Opinion has been ſo long and ſo generally received, yet if our Scheme be the true one, it evidently appears the Blood hath nothing to do with the immediate Contraction of the Muſcles.

* Lectures on Muſcular Motion.

From

From the clofe Connection of the nervous Capillamenta in all or moft of their Ramifications, to thofe of the Arteries, it feems as if the Diaftole and Syftole of the arterial Syftem was fome how ufeful to them. Perhaps it may affift in pufhing on the Succus nutritus, or that clammy balfamic Juice which is in the Nerves, towards their Extremities; but I cannot conceive that the Blood itfelf is in any way affifting towards mufcular Motion, except it be by keeping the Fibres warm, fupple, diftended, and every way ready for the Influx of the nervous Æther.

I have tied up and cut afunder both the carotid and both the crural Arteries of the fame Dog, without deftroying the Motion of one Mufele. Nothing lefs than laying a Ligature on the Aorta defcendens will deftroy the Motion of the hinder Parts; and poffibly this may happen from the great Diftenfion of the Aorta above the Ligature, preffing upon the Nerves which go to the lower Parts.

It is certain indeed, when all the Blood is intercepted the Fibres will foon collapfe, and grow flaccid, and mufcular Motion will ceafe, merely for want of the Warmth, Supplenefs, and Diftenfion which the Mufcles receive from the Blood. But what I think moft reafonable is, that the Blood is no Way concerned as an efficient Caufe in purfing up and contracting the Fibres; it rather, by its Motion through the Mufcles, acts as an Antagonift to their Contraction, by extending and diftending them; for the Blood, by the Diaftole and Syftole of the Arteries, is continually urging on its Paffage through the Mufcles.

Thus I have endeavoured to deduce and illuftrate the Caufe of mufcular Motion from true Principles, by purfuing only thofe Laws of Nature, which our great Philofopher Sir ISAAC NEWTON

 has

has in fo furprifing a manner difcovered to us. But I am far from thinking this a complete Account; I know it requires more Experiments, and better Reafonings than I am Mafter of, to explain it as it ought; and even after all, there are, and ever will be, fome Things above the Reach of our Capacities to demonftrate, any otherwife than by their Effects, or fecond Caufes: Such are, the Nature of an immartial Impulfe; the real Exiftence of fo fubtil a Fluid as is attributed to the Nerves; and the true Caufes of Attraction and Repulfion.

The Exiftence or Non-Exiftence of the nervous Fluid, commonly called the animal Spirits, has been a Controverfy of long ftanding. The firft Searchers into the Structure of the human Body foon found that mufcular Motion depended upon the Nerves, or fomething within them; and this has conftantly been afferted, and admitted as a known Truth. The Advocates for the Exiftence of animal Spirits have generally fuppofed that voluntary Motion was performed by a fudden Inflation of the Mufcles, either by the Power of the nervous Fluid itfelf, or by an inftantaneous Ferment with fome other Fluid; and I am apt to believe, that this Doctrine proving inconfiftent with many Things relating to the Animal Oeconomy to fome known Experiments, might give rife to the vibrating Scheme, where the Exiftence of the of the animal Spirits is denied, and where it is fuppofed that both Senfation and mufcular Motion may be performed merely by the Elafticity of the Nerves, and Contractions firft of all begun in the Brain, and fo communicated to the flefhy Fibres: But this is fo immechanical a Notion as not to deferve an Anfwer; it being impoffible for a vibrating Motion in one Cord or String, were it ever fo elaftic, to caufe a Contraction in another, without the Intervention of fome Fluid.

I

I shall conclude this Lecture therefore with observing, that the Existence of an ætherial Medium in the Nerves is past all manner of Doubt; it being otherwise contrary to the known Laws of Nature for the Nerves to be the Cause of muscular Motion if they were solid, or did not admit the most subtil Fluid, secreted by the Glands of the Brain, to pass through them.

And since it is known from Experiment, that the Muscles grow less in Action, and, consequently, the constituent Particles of every Fibre must run nearer together before such a Phænomenon can happen; we think it very manifest that this Property of Constriction arises from the Principle of corpuscular Attraction being increased and strengthened by the Influence of the nervous Æther; a Principle, which, from the endless Divisibility and Subtilty of another, we know it to exist in Nature from innumerable Observations and Experiments.

LECTURE XVI.

Of the Muscles of the Face, and the inferior Maxilla.

THE Supercilia or Eye-brows, are the two hairy Arches, ſituated at the inferior Part of the Forehead; between the ſuperior Part of the Noſe and Temples, in the ſame Direction with the oſſeous Arches, which form the ſuperior Margin of the Orbits. The Skin in which they are fixed does not ſeem to be much thicker than that of the reſt of the Forehead; but the Membrana Adipoſa is thicker than on the adjacent Parts.

The Extremity of the Eye-brows next the Noſe is called the Head, as being larger than the other Extremity, which is named their Tail. Their Colour is different in different Perſons, and often in the ſame Perſon, different from that of the Hair on the Head; neither is the Size of them always alike. The Hairs of which they conſiſt, are ſtrong and pretty ſtiff; and they lie obliquely, their Roots, being turned to the Noſe, and their Points to the Temples.

The Supercilia have Motions common to them, with thoſe of the Skin of the Forehead, and of the hairy Scalp. By theſe Motions the Eyebrows are lifted up, the Skin of the Forehead is wrinkled more or leſs regularly and tranſverſly; and the Hair,

Hair, and almoſt the whole Scalp, is moved; but not in the ſame Degree in all Perſons; for ſome by this Motion alone can move their Hat, and even throw it off from their Head. The Eyebrows have likewiſe particular Motions which contract the Skin above the Noſe; and all theſe Different Motions are performed by the following Muſcles.

The Frontal Muscles are two thin, broad, fleſhy Laminæ, of unequal Length, lying immediately behind the Skin, and Membrana Adipoſa anteriorly, which Parts they cover from the Root of the Noſe, and through about two Thirds of the Arch of the Eyebrows on each Side, all the Way to the lateral Parts of the Hair on the Forehead. At the Root of the Noſe they touch each other, as if they were but one Muſcle; and at this Place the Fibres are ſhort and longitudinal, or vertical.

The next Fibres on each Side become gradually longer and more oblique, the moſt anterior being always the ſhorteſt and ſtraiteſt; and the lateral the longeſt, and turned moſt obliquely toward the Temples at their ſuperior Extremities.

By this Diſpoſition, an angular Interſtice is formed between the Place where the two Muſcles join, and the Hair on the Middle of the Forehead; but this Diſpoſition is not the ſame in all Subjects; no more than the Wrinkles, and Bounds of the Hair on the Forehead.

Theſe Muſcles are fixed by the inferior Extremities of their fleſhy Fibres, immediately in the Skin, running through the Membrana Adipoſa. They cover the Muſculi Superciliares, and adhere cloſely to them, by a kind of Inter texture. By the ſame Fibres they ſeem to be inſerted in the angular Apophyſes, of the Os Frontis, and to be blended a little with the Muſcles of the Palpebræ

 and

and Noſe. The ſuperior Extremities of their fleſhy Fibres are fixed in the external or convex Surface of the Pericranium. Each of their lateral Portions covers a Part of the temporal Muſcle, on the ſame Side, and adheres very cloſely to it. The ſuperior and inferior Inſertions are graduated.

The Occipital Muscles, are two ſmall, thin, broad, and very ſhort fleſhy Planes, ſituated on the lateral Parts of the Occiput, at ſome Diſtance from each other. They are inſerted by the inferior Extremities of their fleſhy Fibres in the ſuperior tranſverſe Line of the Os Occipitis, and alſo a little above it. From thence they aſcend obliquely from behind forward, and are fixed in the interior or concave Surface of the Pericranium.

The Breadth of theſe Muſcles reaches from the poſterior middle Part of the Occiput, toward the maſtoïd Apophyſis, and they diminiſh unequally in Length, as they approach theſe Apophyſes. From this Inequality in Length, each of them appears, as if it were double in ſome Subjects; and in others they are ſo thin and pale, that they ſeem to be wanting. They are ſometimes covered by an aponeurotic Expanſion of the Trapezii.

The occipital and frontal Muſcles appear to be true Digaſtrici, both in regard to their Inſertions in the Pericranium, and in reſpect to their Action. Their Inſertions in the Pericranium, are oppoſite, one being on the exterior Side, and the other on the interior Side; ſo that this Membrane or Aponeuroſis, may be conſidered, as a middle Tendon of four ſingle Muſcles, that is, which have their fleſhy Fibres fixed only to one Side of their Tendons. The fixed Inſertions of the Occipitales, at the inferior Part of the Occiput, and the moveable Inſertions of the Frontales, in the Skin of the Forehead and of the Supercilia, being well conſidered,

ſidered, together with their reciprocal Inſertions in the ſame Aponeuroſis, ſeem to be a veryconvincing Proof that they are digaſtric Muſcles.

Theſe four Muſcles ſeem always to act in Concert; the Occipitales being only Auxiliaries or Aſſiſtants to the Frontales, the Office of which is to raiſe the Supercilia, by wrinkling the Skin of the Forehead; theſe Wrinkles follow the Direction of the Eyebrows pretty regularly in ſome Subjects, and very irregularly in others.

To be convinced of the Co-operation of theſe four Muſcles, we need only hold the Hand on the Occipitales, while we raiſe the Eyebrows, and wrinkle the Forehead ſeveral times; and we ſhall perceive the Occipitales to move each time, though not in the ſame Degree, in all Subjects. In ſome Perſons the Occipitales ſeem to be relaxed, while the Frontales being in Contraction, move the whole Scalp and Pericranium forward, and then contract to bring them back to their natural Situation.

The Musculi Superciliares are fleſhy Faſciculi ſituated behind the inferior Portion of the Muſculi Frontales, from the Root of the Noſe, to above one half of each ſuperciliary Arch. They are ſtrongly inſerted, partly in the Synarthroſis of the Oſſa Naſi, with the Os Frontis, where they come very near the proper Muſcles of the Noſe, and partly in a ſmall circumjacent Portion of the Orbit. From thence they firſt aſcend a little, and afterwards more or leſs in the Direction of the Eyebrows. They are formed of ſeveral ſmall Faſciculi of oblique Fibres, all fixed by one End, in the Manner already ſaid, and by the other partly in the inferior Extremity of the Muſcles by which they are covered; and partly in the Skin of the Supercilia.

This laſt Portion is eaſily confounded with a Portion of the muſculus Orbicularis Palpebrarum.

The

The Action of theſe Muſcles is to depreſs the Eyebrows, to bring them cloſe together, and to contract the Skin of the Forehead immediately above the Noſe, into longitudinal and oblique Wrinkles; and the Skin which covers the Root of the Noſe, into irregular tranſverſe Wrinkles. This Action as well as that of the Frontales, and of the Muſcles of the Noſe and Lips, is not always arbitrary, but ſometimes mechanical and involuntary. Theſe Muſcles may perhaps likewiſe ſerve to keep the muſculi Frontales, in Equilibrio during their Inaction, they being moveable by both Extremities.

The Muscles of the Palpebræ, are commonly reckoned two; one peculiar to the ſuperior Eyelid, named Levator Palpebræ Superioris; the other common to both, called muſculus Orbicularis Palpebrarum, which has been ſubdivided in different Manners as we ſhall ſee preſently.

Orbicularis Palpebrarum. By the Muſculus Palpebrarum Obliquus, we underſtand all that Extent of fleſhy Fibres, which, by a thin Stratum, ſurrounds the Margin of each Orbit, and from thence, without any Interruption, covers the two Palpebræ all the way to the Cilia. The Fibres which aſcend the Margin of the Orbit are nearly orbicular; but moſt of thoſe which cover the Palpebræ, are tranſverſly oval.

Moſt of them have a common Tendon ſituated tranſverſly between the internal Angle of the Eye, and the naſal Apophyſis of the Os Maxillare.

This is a ſlender ligamentary Tendon, ſtrongeſt where it is fixed in the Bone, and diminiſhing gradually as it approaches the Angle of the Palpebræ where it terminates at the Union of the Points, or at the Extremities of the two Tarſi. The fleſhy Fibres are fixed to it anteriorly, ſo that at

firſt Sight it appears to be no more than a Linea Alba.

From thence one Portion of the Fibres is turned ſuperiorly, the other inferiorly; and both meet again at the external Angle, being united by a particular Kind of Intertexture, very difficult to be explained. When having inforced this Portion of the Muſcle, we examine its poſterior Surface, we obſerve a ſmall thin tendinous Rope, which deſcends through the fleſhy Fibres, and divides them all the way, from the Union of the two Tarſi, to the temporal Margins of the Orbit, where it diſappears; the Fibres which lie beyond it, appearing to continue the main Circuit of the Muſcle.

I divide this Muſcle into four Portions, whereof the firſt is that which ſurrounds the Orbit, and which does not appear to be interrupted toward the Temples; the ſuperior Part of it lying between the Supercilia, and the inferior Part of the Muſculi Frontales.

The ſecond Part is that which lies between the ſuperior Margin of the Orbit, and the Globe of the Eye, and which covers the inferior Margin of the Orbit; ſome of its Fibres being fixed to both Margins of the Orbit.

Riolan divided this into two ſemi circular Portions one ſuperior, the other inferior; the firſt lying between the Muſculus Superciliaris, and the inferior Part of the Muſculus Frontalis, to both which it adheres very much.

The third Portion ſeems to belong more particularly to the Palpebræ, and the greateſt Part of it is ſpent in the Palpebra ſuperior. The Fibres of this Portion meet at the two Angles of the Eye, where they appear to make very acute Inflexions without any Diſcontinuation; but when examined on the other Side next the Globe of the Eye, they

they have in fome Subjects appeared to me to be diftinguifhed into fuperior and inferior.

The greateft Part of thefe Fibres form a tranfverfly oval Circumference, the fhorteft Diameter of which is longer when the Eyes are open than when fhut.

The fourth Portion is an Appendix to the Third, from which it differs chiefly in this, that its Fibres do not reach to the Angles, and form only fmall Arches, the Extremities of which terminate in each Palpebra. This Portion is really divided into two, one for the Margin of the fuperior Eyelid, the other for that of the inferior. RIOLAN names this Portion, Mufculus Ciliaris.

All thefe different Portions of the orbicular Mufcle adhere to the Skin, which covers it, from the fuperior Part of the Nofe to the Temples; and from the Supercilium, to the fuperior Part of the Cheek: When they contract, feveral Wrinkles are formed in the Skin, which vary, according to the different Direction of the Fibres; thofe under the inferior Palpebra are very numerous, and defcend very obliquely from the anterior to the pofterior.

The Skin of the fuperior Palpebra is folded Archways, almoft in a parallel Direction to that of the femi-oval Fibres, the Plicæ interfecting the Levator; whereas the other Folds only interfect the Orbicularis. The radiated and oblique Plicæ feldom appear in young Subjects, except when the firft and fecond Portions of the Orbicularis are in Action; but in aged Perfons, the Marks thereof are vifible at all times.

In Man the fuperior Palpebra has much more Motion than the inferior. The fimple Motions called Twinkling, which frequently happen, though not equally often in all Subjects, are performed in the fuperior Palpebra, by the alternate Contraction

of

of the Levator and ſuperior palpebral Portion of the muſculus Orbicularis; and in the inferior Palpebra, at the ſame time or alternately, by the inferior palpebral Portion of the Orbicularis; but as there is but a ſmall Number of Fibres in this Portion, theſe Motions are but very inconſiderable in this Eyelid.

Theſe ſlight Motions, eſpecially thoſe of the ſuperior Palpebra, are not very eaſy to be explained according to the true Structure of that Part; the Motions which wrinkle the Palpebræ, and which are commonly performed, to keep one Eye very cloſe ſhut, while we look ſtedfaſtly with the other, are explicable, by the ſimple Contraction of all the Portions of the Orbicularis. Theſe Motions likewiſe depreſs the Supercilia, which conſequently may be moved in three different Manners, ſuperiorly by the Muſculi Frontales, inferiorly, by the Orbiculares, and anteriorly by the Superciliares.

The LEVATOR PALPEBRÆ SUPERIORIS is a very thin Muſcle, ſituated in the Orbit, above and along the Rectus ſuperior Oculi. It is fixed to the Bottom of the Orbit, by a ſmall narrow Tendon, near the Foramen Opticum, between the poſterior Inſertions of the Rectus Superior, and Obliquus Superior. From thence its fleſhy Fibres deſcend forward on the Rectus; increaſing gradually in Breadth, and terminate by a very broad Aponeuroſis, in the Tarſus of the ſuperior Palpebra.

There is ſo much Variety to be met with in the Muſcles of the Lips in different Subjects, that it is no Wonder to find them ſo variouſly deſcribed by Anatomiſts, very unlike one from another. In ſome Subjects, Portions of theſe Muſcles are wanting; in ſome they can ſcarcely be diſtinguiſhed, becauſe of the Paleneſs and Attenuation of the Fibres;

and

and in others there are realy fome particular Fafciculi, which are not generally to be found.

The Mufcles of the Lips are commonly divided into common and proper; the common are thofe which end at the Angles or Commiffures of the two Lips; and thofe are proper, which are fixed in one Lip only, which are again fubdivided into the proper Mufcles of the fuperior Lip, and proper Mufcles of the inferior Lip. All thefe Mufcles have particular Names, fome of which are taken from fomething in the Confirmation of the Mufcles, fome from the Infertions or Situation, and fome from the Ufes attributed to them.

The Mufcles to which I confine myfelf may be enumerated in the following Order, viz.

The SEMI ORBICULARES are commonly looked upon as one Mufcle, furrounding both Lips, from whence it is called Orbiculares; but when we examine carefully the Angles of the Lips, we find that the Fibres of the fuperior Lip interfect thofe of the inferior Lip, and we eafily diftinguifh the mufcular Arch of one Lip from that of the other; and for this Reafon I divide this Mufcle into two, and I call them either by the common Name of Semi-Orbicularis, or one of them Semi-Orbicularis fuperior, and the other Semi-Orbicularis inferior; but the Name of Semi-Ovales would be ftill more proper.

The fuperior femi-orbicular Mufcle is oftentimes broader than the inferior; and it has this peculiarity likewife, that all its Fibres do not go to the Corner of the Mouth, but terminate by Degrees, between the Middle and Extremities of this Arch, nearly like the femi-oval Fibres of the fuperior Palpebra.

The inferior femi-orbicular Mufcle is commonly more uniform in the Difpofition of its Fibres.

The

The SUPRA SEMI-ORBICULARES are Fibres which increafe the Breadth of the two lateral Portions of the fuperior Semi-Orbicularis upward, and they appear at firft Sight to be one continued Arch, like the Mufcle laft named, but being narrowly examined, they will be found to be feparated by a fmall Interftice, lying betwixt their contiguous Extremities, which are fixed in the Gums, oppofite to the Margin of that cutaneous Foffula, that defcends from the Septum Narium, to the middle of the Margin of the fuperior Lip. Their other Extremities are confounded with thofe of Semi-Orbicularis fuperior, their Ufes are to draw the Lips clofe together.

The BUCCINATORES are two in Number, each of them are fituated tranfverfly between the pofterior Part of the two Maxillæ, and the Corner of the Mouth; they are broader pofteriorly, and narrower anteriorly, in the Shape of a Triangle or Trapezium, and they form a confiderable Portion of the Cheeks, and for that Reafon are fometimes called the Mufcles of the Cheeks. To have a juft Idea of thefe Mufcles, we muft be made acquainted with a Ligament, on each Side of the Face, which I call Ligamentum Inter-maxillare, becaufe it connects the two Maxillæ, and alfo gives Infertion to the pofterior Fibres of the Buccinator.

This Ligament is ftrong and pretty broad. It is fixed by one End to the exterior Side of the fuperior Maxilla, above the laft Dens Molaris, and at the Side of the Apophyfis Pterygoïdæus, Internus: By the other End it is fixed in the pofterior fuperior Extremity of the oblique prominent Line, on the exterior Side of the inferior Maxilla, below the laft Dens Molaris. It ferves likewife as a Frænum to check and limit the De-

preffion

preſſion of the inferior Maxilla, in opening the Mouth, eſpecially when it is wide open.

The BUCCINATOR is inſerted poſteriorly in three different Places. The middle Fibres are fixed tranſverſly in the Ligamentum Inter-maxillare, and deſcend directly to the Corner of the Mouth. The ſuperior Fibres deſcend in an oblique graduated Manner, from the Alveoli of the ſuperior Maxilla to the Corner of the Mouth; and the inferior Fibres aſcend from the inferior Maxilla in the ſame Manner.

All theſe Fibres contract by Degrees, as they approach the Commiſſure of the Lips, where they run in behind the Extremities and Union of the Semi-Orbiculares, by which they are covered, and to which they adhere cloſely.

There is a large Hollow between this Muſcle, and the Maſſeter filled with Fat; its Uſe is not only to move the Cheeks with the Eyes, but alſo to contract the Cavity of the Mouth, by bringing them internally, and ſo thruſt the Meat between the Teeth for its better Communication.

The ZYGOMATICI MAJORES are two Muſcles ſituated one on each Side between the Zygoma, and the Corner of the Mouth. Each Muſcle is thin, long, oblique, and fixed by one Extremity to the inferior Margin of that Portion of the Os Malæ, which is connected with the Zygomatic Apophyſis, of the Os Temporis; from thence it deſcends obliquely from behind forward, being in its Paſſage, commonly involved in Fat. It ends at the Commiſſure of the two Lips, adhering ſtrongly to the Buccinator which covers it. This Muſcle is very often complex; its Uſe is to draw the Lips ſuperiorly.

MUSCULI

MUSCULI PROPRII LABII SUPERIORIS.

The ZYGOMATICI MINORES are two ſmall ſlender Muſcles, lying above the great Zygomatici, and almoſt parallel to them. Their ſuperior Extremities, ſeem to be a Detachment from the inferior Fibres of the Orbicularis Palpebrarum; but they may be always diſtinguiſhed. Their inferior Extremity unites with the neighbouring Inciſorius. Theſe Muſcles are quite buried in Fat, and for that Reaſon often diſapear; their Uſes are the ſame as the former.

Elevator of the ſuperior LIPO CANINI is fixed by a broad Inſertion, in the ſuperior Maxilla, above the Socket of the Dens Caninus, in a Depreſſion below the inferior Margin of the Orbit, near the Os Malæ. From thence it deſcends a little obliquely, croſſing the inferior Extremity of the Zygomaticus Major, which covers it at this Place. Afterwards it terminates at the Extremity of the Arch of the Semi-Orbicularis ſuperior, and communicates by ſome Fibres, with the Triangularis. I formerly looked upon this as a neutral Muſcle, that is being neither a proper Muſcle of the Lip, nor common to both. Its Uſes is to draw the ſuperior Lip externally, and when both act, to put it down.

INCISORII LATERALES: Each of theſe two are a ſort of Biceps; its ſuperior Part being divided into two Portions, which unite below. One of thoſe ſuperior is larger than the other, and is fixed in the Os Maxillare below the middle Tendon of the Orbicularis Palpebrarum ſeeming to communicate by ſome Fibres, with the contiguous Fibres of that Muſcle; thence it deſcends a little obliquely toward the Cheek, along the Apo-

phyſis Naſalis, mixing with the Pyramidalis Naſi, and ſending ſome Fibres to the Nares; afterwards it paſſes over and adheres to the Myrtiformis, or Tranſverſalis Naſi, and unites with the other Portion.

This other Portion is fixed by a broad Inſertion, immediately below the Margin of the Orbit, in the Os Maxillare, near the Union of this Bone with the Os Malæ, and likewiſe a little in the laſt named Bone, being at this Place covered by the inferior Portion of the Orbicularis Palpebrarum, with which it has ſometimes a kind of Communication: From thence runs down obliquely toward the Noſe, and unites with the firſt Portion.

The two Portions thus united and contracting in Breadth, run behind the Semi-Orbicularis ſuperior, and are fixed therein oppoſite to the lateral Dens Inciſorius. Sometimes it ſends, a ſmall Faſciculus of Fibres to the Muſculus Caninus, which may be reckoned an Aſſiſtant to that Muſcle, and named Caninus Minor.

The Incisorii Medii or Elivators of the Lips are commonly called Inciſorii Minores Cowperi, or Inciſorii Minores Superiores. They are two ſmall ſhort Muſcles, ſituated near each other below the Septum Narium. They are fixed by one Extremity in the Os Maxillare, on the Alveoli of of the firſt Inciſores, behind the Semi-Orbicularis Superior; and by their other Extremity, in the middle and ſuperior Part of the Subſtance, of the ſuperior Lip, near the Nares, in which they likewiſe have an Inſertion; and they ſometimes ſend lateral Fibres, to the Semi-Orbicularis. When it acts it draws that Lip externally, and when both in concert, pull it ſuperiorly.

Musculi

Musculi Proprii Labii Inferioris.

Each of thofe two Triangulares * or Depreffors of the inferior Lips is fixed externally by a broad Extremity; the Bafis of the inferior Maxilla from the Maffeter to the Foramen near the Chin. From thence it afcends, contracting in Breadth, in a bent triangular Form, runs in between the Extremities of the Buccinater, and Zygomaticus Major, to both which it adheres very clofely, and terminates at the Commiffure of the Lip, partly in the Semi-Orbicularis fuperior, and partly though not always equally in the Semi-Orbicularis inferior. This Mufcle feems fometimes to be a Continuation of the Caninus Major.

The Quadratus or Elevator Menti of the Chin forms the thick Part of the Chin, below the under Lip. It is a very complete Mufcle, and very difficult to be prepared, becaufe its Fibres are interwoven with a great Quantity of Fat, or a pellicular Texture, of the Membrana Adipofa. It is firft of all inferted anteriorly to the inferior Maxilla, where it partly fills, the broad Foffula on each Side of the Symphyfis. From thence it afcends interfecting, along the Symphyfis, the contiguous Fibres of the Skin, and terminates by a broad Infertion, in the Semi-Orbicularis Inferior. The Direction of the other Fibres, of which it is compofed, varies in different Subjects, and it communicates by fome Fibres, with the Cutanei.

The Incisorii Inferiores or Elevators of the inferior Lips are two fmall Mufcles, commonly mentioned with the Addition of Cowper's Name.

* Profeffor Winslow notes this amongft the proper Mufcles of the inferior Lips, but with Submiffion to his Authority, I think they are common to both Lips.

Each of them is fixed by the fuperior Extremity, on the Alveoli of the lateral Incifores, of the inferior Maxilla. From thence, they defcend approaching each other, and are inferted together in the inferior Part of the middle of the Semi Orbicularis Inferior.

On the external Infertion of the fuperior of each of thefe Mufcles, we meet with a Fafciculus of Fibres, which feem to be detached from it near the Incifores. This Fafciculus goes off laterally in Form of an Arch, and unites with the Fibres of the Semi-Orbicularis Inferior, with which it may be eafily confounded. It may be looked upon as a Mufculus Acceflorius, to the Semi-Orbicularis Inferior, or as a Collateralis to the Inciforius Minor.

The Muscles of the Inferior Maxilla are five Pair.

The Masseter is a very thick flefhy Mufcle, fituated on the lateral Part of the Cheek. It feems to be compofed of three Portions, like a Triceps, viz. one large and external, one middle, and one fmall and internal.

The external Portion is fixed by one tendinous Extremity to all the inferior Margins of the Os Malæ, and a little to the adjacent Parts of the Os Maxillare and Apophyfis Zygomatic of the Os Temporum. Thence it defcends obliquely backward, (being entirely flefhy,) and is inferted by the other Extremity in the rough Impreffion on the external Side of the Angle of the inferior Maxilla.

The middle Portion is fixed by one End to the inferior Margin of the whole Apophyfis Zygomatic of the Os Temporum and a very little to that of the Os Mallæ. Thence it defcends a little obliquely forward in an oppofite Direction to the firft

first Portion, under which it crosses, and is inserted by its other Extremity in the Middle of the Inside of the Ramus of the inferior Maxilla, near the Insertion of the external Portion with which it mixes.

The third Portion which is least and most internal, is fixed by one Extremity to the internal Labium of the inferior Margin, and also to the Inside of almost all the Zygomatic Arch; and by the other, to the Basis of the Coronoïd Apophysis, where it mixes wholly fleshy with the Insertion of the middle Portion. This third Portion by its Nearness of Situation, seems sometimes to be an Appendix of the Temporal Muscle.

The TEMPORAL Muscle, is broad and flat resembling the Quadrant of a Circle in Figure, it occupies all the semi-circular or semi-oval Plane of the lateral Region of the Cranium. The Temporal Fossa and Part of the Zygomatic Fossa. From this Situation it has its Name and likewise that of Crotaphites which is sometimes given to it.

To conceive justly the Insertions of this Muscle: It must be observed that through all the Circumference of the semi-circular Plane already mentioned. The Pericranium is divided into two Laminæ. The internal Lamina, sometimes taken for a particular Periosteum, covers immediately all the osseous Parts of this Region. The external Lamina separated from the other, is spread out like an aponeurotic or ligamentary Tent, by means of its Adhesions to the Os Frontis, to the posterior Margin of the superior Apophysis of the Os Mala, to the superior Margin of all the Zygomatic Arch, and to the Root of the Mastoïd Apophysis.

This Muscle is composed of two Laminæ of fleshy Fibres, fixed to the two Sides of a tendinous

Lamina nearly of the fame Breadth with them by which they are feparated, it being fpread quite through the Mufcle like a concealed middle Tendon, as may be plainly feen by dividing the Mufcle all the way to the Bone, according to the Direction of its Fibres. The Body of this Mufcle thus formed is inclofed between the two aponeurotic or ligamentary Laminæ in the following manner.

The internal flefhy Lamina is fixed by a broad radiated Infertion to all the femi-circular Lamina of the Cranium, by the Intervention of the internal Lamina of the Periofteum.

Thus it is fixed to the lateral external Part of the Os Frontis, and to its external angular Apophyfis, to the inferior Part of the Os Parietale, to the fquamous Portion of the Os Temporis, to the great Ala or temporal Apophyfis of the fphenoïd Bone, by which the temporal Foffa is formed; and a little to the pofterior Side of the internal orbitary Apophyfis of the Os Malæ which forms Part of the Zygomatic Foffa.

Through all this Space the flefhy Fibres contract gradually, by means of their adhefions to the tendinous Laminæ, which diminifhes in Breadth, and increafes in Thicknefs, and in Proportion, as it defcends. The external flefhy Lamina is fixed in the fame radiated Manner to the Infide of the external Lamina of the Pericranium from the great femi-circular Circumference all the way to a fmall Portion of this Lamina more or lefs femi-circular, above its Infertion in the Zygomatic Arch. Here the flefhy Fibres leave the external Lamina, and the void Space thus formed between the fmall femi-circular Portion, and the flefhy Fibres is commonly filled with Fat.

Through the whole Extent of this Infertion the flefhy Fibres gradually contract, and adhere to the Outfide of the middle tendinous Laminæ in the fame

ſame manner as the internal Lamina adheres to the other Side but in a contrary Direction.

The middle tendinous Lamina continuing to contract by Degrees, ends at length in a very conſiderable Tendon; the Extremity whereof, which is in a manner double, incloſes the coronoïd Apophyſis of the inferior Maxilla, being ſtrongly inſerted in the Margins and Inſide thereof, and alſo a little in that Part of the Bone which lies between the two Apophyſes. The internal Portion of this Inſertion is thicker and has more fleſhy Fibres then the external, which is almoſt entirely tendinous or aponeurotic.

There is another ſmall Lamina reckoned by ſome to be a Portion of this Muſcle, which in reality is no more than the third Portion of the Maſſeter, as may be eaſily perceived by ſawing of the Zygomatic Arch at the two Ends, and then turning it down; for this ſmall Muſcle parts from the Temporalis without Difficulty, and continues to adhere to the Maſſeter.

Pterygoïdæus Major or Internus.

This Muſcle lies on the Inſide of the inferior Maxilla, almoſt in the ſame Manner as the Maſſeter does on the external Side, being of the ſame Figure with that Muſcle, only ſmaller and narrower.

It is fixed above in the Pterygoïd Cavity, chiefly to the Inſide of the external Ala of the Apophyſis Pterygoïd. This Inſertion is fleſhy; and from thence the Muſcle has its Name: It deſcends obliquely toward the Angle of the inferior Maxilla, and is inſerted a little tendinous in the Inequalities on the Inſide thereof, oppoſite to the Inſertion of the Maſſeter; it might be called alſo Maſſeter Internus.

PTRYGOÏDÆUS MINOR OR EXTERNUS.

This is an oblong fleſhy Muſcle, much ſmaller then the other, and ſituated almoſt horizontally between the external Side of the Apophyſis Pterygoïd, and the Condyloïd Apophyſis of the inferior Maxilla; the Subject being conſidered in an erect Poſture.

It is fixed by one Extremity on the external Side and Margin of the external Ala of the Pterygoïd Apophyſis, filling the Foſſula, which is at the Baſis of this Apophyſis, near the Baſis of the Apophyſis of the Sphenoïd Bone.

From thence it deſcends poſteriorly and a little externally, into the void Space between the Apophyſis of the inferior Maxilla, and is inſerted anteriorly in the condyloïd Apophyſis at a ſmall Foſſula immediately under the inner Angle of the Condyle, it is alſo fixed to the capſular Ligament of the Articulation.

DIGASTRICUS is a ſmall long Muſcle ſituated laterally between the whole Baſis of the Maxilla and the Throat. It is fleſhy at both Extremities and tendinous in the Middle, as if it conſiſted of two ſmall Muſcles joined endways by a Tendon, and from thence it is called Digaſtricus in Greek, and Biventer in Latin.

It is fixed by one fleſhy Extremity in the Sulcus of the Maſtoïd Apophyſis; from thence it deſcends anteriorly inclining towards the Os Hyoïdes, where the firſt fleſhy Body ends in a round Tendon; which is connected to the lateral Part and Root of the Cornua of that Bone by a kind of aponeurotic Ligament, and not by a Vagina or Pulley as appears at firſt Sight, becauſe of its Paſſage by the Extremity of the Muſculus Styloglоſſus.

Here

Here the Tendon is incurvated and presently ends in the other fleshy Body which is immediately above the internal Labium of the Basis of the Chin near the Symphysis, in a small unequal Depression. This Insertion is broader than that of the other Extremity; sometimes the anterior Insertions of the two Digastrici touch each other, and sometimes several of their Fibres cross each other considerably.

Platisma Myoïdes are two Cutaneous Muscles which form a kind of fleshy Membrane, which covers the whole Foreside of the Throat and Neck, from the Cheek and Chin, all the way down below the Claviculæ, and adheres very strongly to the membranous or aponeurotic Expansion before described. This Expansion has a particular Adhesion to the anterior Portion of the Basis of the inferior Maxilla, of the same Kind with that at the inferior Part of the Zygoma, and it is spread over all the Muscles that lie round the Neck, and over the superior Portion of the Pectorales Majores, Deltoïdes, and Trapezi.

The Fibres of each cutaneous Muscle descend obliquely upward and forward, and meet and seem to intersect those of the other Muscle, at acute Angles, from the Sternum, all the way to the Chin.

They adhere strangely to the inferior Portion of the Masseter, Triangularis, and Buccinator, their fleshy Fibres become aponeurotic, but continue longer on the Triangularis, being mixed with the Fibres of that Muscle all the way to the Commissure of the Lips. They likewise advance a little, on the circumjacent Portion of the Quadratus.

The Portion of these Muscles, which answers to the Basis of the Triangularis, is in a manner divided into two fleshy Laminæ, the outermost of which

which is what advances over the Triangularis, and Quadratus, the other being inſerted ſeparately in the inferior Maxilla.

I have ſometimes obſerved a Part of the fleſhy Extremity of the right Side, to paſs before the Symphyſis of the Chin, over a little Part from the left Side, the one covering the other.

The commom Muſcles of the Lips either draw both Corners of the Mouth at once, or only one at a time, according to the different Direction of their Fibres.

The proper Muſcles pull the different Parts of the Lips, in which they are inſerted. The Buccinators, in particular, may ſerve to move the Food in Maſtication. An entire Treatiſe might be written on the almoſt innumerable Combinations of the different Poſtures, in which a Man may put his Face, as I ſhall ſhew elſewhere.

None are more affecting, than thoſe produced by the Cutanei alone, eſpecially in Weeping, which they do by their Adheſions to the Triangulares, &c. But their Inſertions in the Bone of the inferior Maxilla, they draw up the inferior Part of the Integuments of the Neck, and thoſe of the Breaſt next to theſe, for they cannot move the Maxilla.

In old People, and in thoſe who are very much emaciated, theſe Muſcles may be perceived by the Eye, under the Skin, and on the Neck.

Muscles of the Nose*.

Six Muscles are commonly reckoned for the Dilation of the Noſe. Two Recti, called alſo Pyrami-

* Dr. Douglas in his Myography, allows but one Pair to the Noſe.

Pyramidales or Triangulares; two Obliqui or Laterales, and two Tranfverfi or Myrtiformes.

In very mufcular Bodies, there are likewife fome fupernumerary Mufcles, or fmall Acceffórii. The Nofe may alfo be moved in fome Meafure by the Mufcles of the Lips, which in many Cafes become Affiftants, to the proper Mufcles of this Organ.

The Musculus Pyramidalis, or anterior on each Side, is inferted by one Extremity in the Synarthrofis of the Os Frontis, and Offa Nafis, where its flefhy Fibres mix with thofe of the Mufculi Frontales, and Superciliares. It is very flat, and runs down the Side of the Nofe, increafing gradually in Breadth, and terminating by an Aponeurofis, which reprefents the Bafis of a Pyramid, and is inferted in the moveable Cartilage which forms the Ala of the Nares.

The Oblique Descendens or Lateral Muscle, is a thin, flefhy Plane, lying on the Side of the former, and in fome Subjects, appearing to form one broad Mufcle, with it. This is poffibly the Reafon why the anterior Mufcle has been termed Triangularis. The lateral Mufcle is fixed by its fuperior Extremity to the Apophyfis Nafalis of the Os Maxillare, below its Articulation with the Os Frontis, and fometimes a little lower than the Middle of the inner Margin of the Orbit. From thence it defcends toward the Ala Narium, and is inferted in the moveable Cartilage, near the Os Maxillare, being covered laterally by a Portion of the circumjacent Mufcle of the fuperior Mufcle of the fuperior Lip, with which, in fome Subjects, it appears to be confounded.

Obliques Acendens, or Tranfverfe Inferior, are called alfo Myrtiformis, is inferted by one End in the Os Maxillare, near the inferior Margin of the Orbit, much about the Place which anfwers to the Extremity of the Socket of the Dens Caninus,

on the fame Side. From thence it defcends almoft tranfverfly upward, and is fixed in the lateral Cartilages of the Nofe, over which in fome Subjects, it feems to run to the Alæ of the great Cartilage and to be inferted there.

The firft two Pair of thefe Mufcles, raife and dilate the Alæ of the Nares, when they act; and at the fame time, raife the fuperior Lip, by means of their Connection, with the Mufcle of that Part. They likewife wrinkle the Skin on the Sides of the Nofe.

As for the Contraction of the Noftrils, it feems to depend on the Action of fome flefhy Fibres detached from the Orbicular Mufcle of the Lips, which terminate in the Margin of the Noftrils and Cartilage which divides them, wherefore the Action is only fenfible in depreffing the fuperior, in in order to make it meet with the inferior Lip. But this Kind of Clufion of the Noftrils is never fhut fo exact as to fecure the Nofe, from the Ingrefs of any extrenous Impreffions, whatever Pain we take in contracting this Mufcle.

Uses of the Muscles which move the inferior Maxilla.

The two Temporales acting together, raife the inferior Maxilla, prefs the Teeth againft the fuperior Teeth, and pull it back when it has been carried fo far forward, as that the inferior Incifores get before the fuperior. They perform the leaft Motion by their moft pofterior Portion which paffes over the Root of the Zygomatic Apophyfis, and the other Motions by theCo-oper at o ns of all their mufcular Radii.

The two Masseters ferve to raife the inferior Maxilla to pufh the inferior Teeth againft the Superior, in which they co-operate with the Temporales.

rales. They likewise bring this Maxilla anterior, by their external and largest Portion; and move it laterally by their superior Portions acting alternately. By the Co-operation of all the three Portions, they press the lower Teeth against the upper.

Both Pterygoïdæi Interni serve to raise the lower Maxilla to bring the inferior Teeth near the superior, and to move the Maxilla laterally, as in grinding the Food. They cannot bring the Maxilla anteriorly in Order to set the inferior Incisores before the Superior, in which Action they are Antagonists to the posterior Portion of the Temporales and the great Portion of the Masseters. When one of them acts, it carries the Chin obliquely forward, or twines it towards the other Side. This oblique Motion is performed alternately by these two Muscles acting singly.

The two Digastrici* serve to depress the inferior Maxilla and to open the Mouth, in doing which, the Mechanism of these Muscles has appeared to all Anatomists to be very singular, on Account of their middle Tendons, their Insertions, Adhesions, and their manner of pressing by another Muscle. The Incurvation of this middle Tendons, has not only been looked upon as necessary to change the Direction of the Muscles, but it has been believed that without this Change of Direction, they could not have depressed the Jaw any farther, than the Weight of the Maxilla would contribute to that Action.

This Incurvation and Passage has been compared to that of a Rope over a Pulley, without which Advantage it was thought that these Muscles

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* Professor Monro does not admit digastric Muscles to depress Maxilla, but their Uses are for the Deglution. See Medical Essays Vol. 1. Article 9.

could

could not reſiſt the continual Efforts of the powerful Antagoniſts, nor overcome any exterior Oppoſition, ſuch as the Hand preſſing upon the Chin. But when we examine carefully the Structure of the Maxilla and the Inſertions of theſe Muſcles, it appears evidently that their Connexion with the Os Hyoïdes is not neceſſary for the Uſe aſſigned to them of depreſſing the Jaw; as may be proved both in a Skeleton and on a freſh Subject.

In a Skeleton in which the Motion of the inferior Maxilla preſerved by Art, we need only tie a piece of Packthread to the lower Part of the Chin where the Digaſtricus is inſerted, and then keeping the inferior Maxilla cloſe to the ſuperior, by any proper Contrivance, paſs the other End of the String through the Maſtoïd Sciſſure, and we ſhall perceive by pulling the String in a ſtrait Direction between theſe two Places, that the Maxilla will be depreſſed.

This Experiment may be made without the Help of a Spring, or any other Contrivance to keep the Maxilla ſhut, by ſimply inverting a proper Cranium, ſo that the inferior Maxilla, may by its own Weight fall on the ſuperior; for by drawing the String as before, the inferior Maxilla will be raiſed, that is, parted from the other, and by letting the String go, it will fall back again to its firſt Situation.

On a freſh Subject the Experiment may be made in the following Manner. The Connexion of the Digaſtricus with the Os Hyoïdes and Muſcles, Stylo Hyoïdæus begin intirely deſtroyed; let it be pulled by its poſterior Extremity directly toward the maſtoïd Sciſſure, in the ſame Manner as the String was drawn, in the foregoing Experiments.

Anatomiſts have not conſidered that the two Rami of the inferior Maxilla are crooked or angular Levers, and that each Degaſtricus paſſing by the

the Angle in that Bone, ought to be looked upon as being inserted therein, so that the Action of the Lever is to be confined to that Portion which lies between the Angle and the Condyle, without taking in what lies between the Angle of the Chin.

It may be asked therefore why the anterior Insertion of the Degastricus reaches so far as the Chin, since it might have been in the Angle of the Bone? and what is the Use of its Connexion, with Os Hyoïdes, of its Incurvation and Change of Direction? The first Question is answered by calling to Mind what has been said about the Extent or Largeness of Motion, about the Necessity of long Fibres for large Degrees of Motion, and about lateral Motion. Had this Muscle been inserted in in the Angle, its Fibres would not have been proportioned to the Dregree of Motion required, and for the same Reason, the lateral Motions would have been obstructed.

In Answer to the second Question about the Connexion of this Muscle with the Os Hyoïdes and its Incurvation, it is to be remembered that the Degastricus has another Use, besides that of depressing the inferior Maxilla; which is to assist in Deglution, of which it is one of the principal Organs. Winslow has demonstrated this Use of the Digastricus above eight Years ago, in his public Courses in the College of Physic and at the Royal Garden, but as the whole Mechanism of Deglution cannot be explained, till the Tongue, Larynx, and Pharynx, have been described; I shall only add in this Place the following Remarks, to prove the Use of the Digastrici in that Action.

We cannot swallow without raising the Larynx or Pomum Adimi, as it is commonly called, at the same time, as every one may satisfy himself laying his Hand on that Part of the Throat in the Time of Deglution. We are likewise obliged to keep

keep the inferior Maxilla raifed while we fwallow, and when it is depreffed we find that Action impoffible. Laftly, the Larynx cannot be raifed but by Means of its Connexion with the Os Hyoïdes; and the Mufcles of that Bone are too weak to refift the Efforts of the Bafis of the Tongue, and of the folid Food which we fwallow.

Therefore while the temporal and maffeter Mufcles keep the inferior Maxilla clofely applied to the fuperior in Deglution, the Digaftrici contract at the fame Time, as may be felt by putting the end of the Finger upon the Place where they are inferted in the Edge of the Chin. And as the inferior Maxilla remains immoveable, the Degaftrici are heightened by their Contraction, and by the Connexion of their middle Tendons with the Os Hyoïdes, they raife that Bone and the Larynx together with it. The Force of thefe Mufcles is very confiderable, as may be fhewn by laying the Elbow on a Table, and leaning with the Chin on the Hand, while we endeavour at the fame time to deprefs the inferior Maxilla; for as in that Cafe this Jaw cannot defcend, the Digaftrici by their Infertions, in the Apophyfis Maftoïdæ, raife the fuperior Maxilla. A Piece of Wood fupporting the Chin in Place of the Arm, will render this Experiment more fenfible and more certain. The involuntary Motion termed Yawning, is likewife a Proof of the Strength of thefe Mufcles.

In the Action of the Digaftrici in Deglution, we meet with one very fingular Phænomenon, of which there is hardly another Example to be found among all the Mufcles of the human Body. For in all other Inftances, wherever antagonift Mufcles act at the fame Time, they all co-operate in producing what is called a Tonic Motion but in this Cafe the Levators and Depreffors of the inferior Maxilla act together for different Ufes; that is

is, the temporal and pterygoïd Muſcles are in Action to raiſe the Jaw and keep it in that Situation, while the Digaſtrici, their Antagoniſts, perform an Office which has no Relation to that Bone.

Two Eminences in one Bone articulated with two Cavities in another, allow only of two contrary Motions as in a Ginglymous, and in the Articulation of the Occipitis with the firſt Vertebra. But the inferior Maxilla, though articulated by the Condyles with the glenoïd Cavities of the Os Temporum, has four direct Motions, one anteriorly, one poſteriorly, one inferiorly, and one ſuperiorly; and two lateral Motions, one to the right, the other to the left. And laſtly, in all Degrees of direct Motions, it may at the ſame time have any Degree of lateral Motion.

This Contrivance depends on the inter-articular Cartilages deſcribed among the freſh Bones. In the inferior Side of each of theſe Cartilages, there is but one Cavity ſuited to the Convexity of the Condyle, which it receives; and is not turned directly inferiorly, but obliquely poſteriorly; as the Condyle is not turned ſuperiorly, but obliquely anteriorly. The ſuperior Side is concave anteriorly, and convex poſteriorly, anſwering to the articular Eminence and Foſſula of the Os Temporis.

In the natural Situation of the inferior Maxilla, and while it remains in Inaction, it is ſo diſpoſed as that the anterior Convexity of the Condyles anſwers obliquely to the poſterior articular Eminences of the Oſſa Temporum, and with this Diſpoſition, that of the inter-articular Cartilages agree.

In the direct Motions upward, the Cartilages ſlide poſteriorly and ſuperiorly toward the Meatus Auditoricus, the Condyles ſtill continuing in the Cavity of their lower Sides, as is moſt evidently

perceived when we prefs the Teeth hard againft each other ; and the fame thing happens in the direct Motions forward. In the direct Motions downward, the Cartilages flide downward and forward ; the Condyles ftill remaining in their inferior Cavities, and the fame happens in the direct Motions.

In the lateral Motions, the Condyles are carried alternately to the right and left Sides, and the Cartilages follow their Motions ; fo that the Condyle on that Side toward which the Maxilla is turned externally, and that on the oppofite Side finks inward ; the prominent Condyle having at the fame time a fmall Motion backward, and the other Condyle forward.

From thefe Obfervations we learn that the ginglymoïd Motions of the inferior depend particularly on the inferior Cavities of the inter-articular Cartilages ; and that the Motions forward, backward, and to either Side depend on the fuperior Side of thefe Cartilages. The Pterygoïdæi Interni move the Maxilia anteriorly, the pofterior Portions of the Temporales move it pofteriorly ; the left Pterygoïdæus Internus turns it to the right, and the Pterygoïdæus Internus to the left. The Pterygoïdæus Externus of one Side, and the pofterior Portion of the Temporalis of the other Side, may at the fame time perform the fmall Motions before mentioned.

LEC-

LECTURE XVII.

MYOGRAPHY.

Of the Abdominal Muscles.

BY the Mufcles of the Abdomen, we mean thofe which form principally the Sides or Circumference of that Cavity. They are commonly ten in Number, five on each Side; eight whereof are very large, the other two very fmall.

Of thefe Mufcles, two are long, called Mufculi Recti; two fmall, called Pyramidales; fix broad, two of which are named Obliqui Externi; two Obliqui Interni, and two Tranfverfales. The Pyramidales are wanting in fome Subjects: Sometimes there is but one, and fometimes three. The Name of thefe two Mufcles has been taken from their Figure, thofe of the other eight from the principal Direction of their Fibres.

Thefe ten Mufcles lie in Pairs, and thofe of each Side appear to be feparated by a kind of tendinous Line or Band running along the anterior Part of the Abdomen, from the Cartilago Enfiformis to the Symphyfis of the Offa Pubis, and including the Umbilicus; above which it is pretty broad, but narrow below, efpecially near the Offa Pubis.

This tendinous Band is named Linea Alba, which

 is

is only formed by the Intexture of the Tendons of fix broad Mufcles.

I fhall here defcribe only the five Mufcles of one Side; the other five being exactly like thefe; and the fame Method will be obferved through the whole of this Treatife, as we did that of the Bones.

OBLIQUUS EXTERNUS, or Afcendens is a broad thin Mufcle, flefhy fuperiorly and pofteriorly, tendinous on the anterior and greateft Portion of the inferior Part. It reaches from half the lateral and inferior Part of the Thorax, to almoft half the lateral and fuperior Part of the Pelvis; and from the pofterior of the Regio Lumbaris to the Linea Alba.

It is fixed fuperiorly to the Ribs, inferiorly to the Os Ilium, Ligamentum Fallopii, and Os Pubis, and anteriorly to the Linea Alba. The pofterior Portion next the Lumbar Vertebræ has commonly no true mufcular Infertions.

In the firft Place it is fixed to eight Ribs (feldom to nine) that is, from the fifth true Rib to the laft of the falfe, by the fame Number of Angles of its flefhy Portion in the following Manner. It adheres to the external Labia of the inferior Margins of the two or three laft true Ribs, and of the four following falfe Ribs, at their offeous Extremities; to the Extremity of the Cartilage of the laft falfe Rib to the external Labium of the inferior Margin of that Rib, and a little to the broad Ligament which connects it to the tranfverfe Apophyfes of the firft Vertebra of the Loins.

The Infertions in the offeous Extremities of the Ribs are at different Diftances from the Cartilages in the fixth, at a little more Diftance; in the fifth the Diftance is about an Inch; in the firft falfe Rib two Inches; in the fecond and third, three Inches; in the fourth, about two Inches, and

fometimes

ſometimes leſs ; in the fifth, the Inſertion reaches, and in a manner ſurrounds, the Cartilage.

The Name of the Digitations or Indentations has been given to theſe angular Inſertions, becauſe they join like a Number of the ſame Kind belonging to other Muſcles, as the Fingers of the two Hands are locked between each other. Three or four of theſe Digitations belong to the Serratus Major ; and the ſame Number to the Latiſſimus Dorſi. The three or four loweſt Digitations join likewiſe thoſe of the Serratus Poſtericus inferior, which are covered by the Extremities of the Latiſſimus Dorſi.

Though theſe Digitations appear entirely fleſhy, yet they are almoſt a little tendinous poſteriorly. They ſeem to increaſe in Breadth as they deſcend, and often unite more or leſs with the intercoſtal Muſcles in their Paſſage over them. Sometimes they communicate likewiſe with the pectoral Muſcle, the Serratus Major, and Latiſſimus Dorſi, by diſtinct Faſciculi of fleſhy Fibres, which are true reciprocal Continuations of theſe Muſcles.

There are likewiſe other internal Inſertions covered and hid by thoſe which appear externally, and which belong to the Ribs lying immediately below thoſe to which the external Digitations are fixed. Thus the Digitation fixed in the laſt true Rib ſends off a Faſciculus to the firſt falſe one as it aſcends anteriorly thereof.

The firſt Digitation, or that belonging to the fifth true Rib, appears longer than the reſt, and is about the Breadth of two Fingers, having communicating Fibres with the Pectoralis Major. The ſecond, or that of the ſixth true Rib, is about an Inch in Breadth, and unites a little with one Digitation of the Serratus Major. The third, or that of the ſeventh true Rib, is about three Fingers in Breadth, and runs for a ſmall Space toward the

Cartilage externally to the Rib. The fourth, or that of the firft falfe Rib, mixes by fome of its anterior Fibres with thofe of the Serratus Major. The fifth, or that of the fecond falfe Rib, mixes both with the foregoing and the firft Digitation of the Latiffimus Dorfi, and runs for fome Space on the Surface of the Rib. The fixth, or that of the third falfe Rib is about two Fingers in Breadth, and fends off a Fafciculus of Fibres to the Serratus Major. The feventh is of the fame Breadth with the former, and fome of its Fibres are continued to the Serratus Poftericus inferior. The eighth, or that belonging to the loweft falfe Rib, has been already difcribed.

From thefe Infertions of the Ribs, the Fibres of this Mufcle run down obliquely from behind forward. Thofe which come from the three loweft Ribs are lefs oblique than the reft, appearing to form a diftinct Portion, which continues flefhy all the way to the external Labium of the Crifta Offis Illium, in which it is inferted from the pofterior Part of this Portion feems to me to confift of a double Lamina.

The other Portion of this Mufcle, though not altogether feparated from the former, runs more obliquely; and after fome Space, its flefhy Fibres degenerate into a ftrong broad Aponeurofis, or thin Tendon; the Extremities of the flefhy Fibres from the fifth true Rib to the anterior Spine of the Os Illium, forming a Line, which, till it reaches as low as the Umbilicus, is ftrait, and thence inferiorly, is incurvated pofteriorly. One Portion of the tendinous Lamina defcends to the anterior and fuperior Spine of the Os Ilium, whence it unites a little with the fuperior Tendon of the Mufculus Satorius, and afterwards is continued to the Spine of the Os Pubis, being by its inferior Margin firmly

ly united to the Ligamentum Fallopii, and adhering cloſely to the Faſcia Lata.

This Aponeuroſis grows firmer and thicker in its Progreſs toward the Os Pubis, and in old Age becomes hard and dry; for which Reaſon, Hernias are moſt troubleſome in old People, and more difficult to be cured. A little before it reaches the Os Pubis, it is divided into two Portions, one ſuperior or anterior, the other inferior or poſterior, between which a Fiſſure or Opening is left of a particular Kind.

The ſuperior or anterior Portion obliquely deſcends toward the Spine or the Os Pubis, croſſes over the Foreſide of the Symphyſis, and is inſerted in the inferior broad Part of the Os Pubis on the other Side. As it paſſes the Symphyſis, it croſſes the like Portion of the other external Oblique, and their Fibres decuſſate each other.

The inferior or poſterior Portion deſcending more inferiorly in the middle Part of the Symphyſis, ſome ſmall Portion of it being continued to the Os Pubis on the other Side.

Near their Extremities theſe two Portions approach, ſo that the Opening formed by them is in ſome meaſure oval, but narrower below than above. Through this Opening the ſpermatic Veſſels paſs in Men, and the round Ligaments in Females; but in them the Opening is much inferior than in Males. It is about two Fingers Breadth in Length, and about half a Finger in Breadth at its ſuperior Part, and is there ſtrengthened by ſeveral tendinous Fibres detached obliquely from each Side, which form a ſort of roundiſh Border, from whence theſe Openings got the name of Annular or Rings. Theſe collateral Fibres hardly appear in Children.

The inferior or poſterior Portion ſends off a particular Expanſion to the Faſcia Lata, which hav-

ing formed a Covering for the Inguinal Glands, is afterwards loft in the Fat.

The remaining Part of the Tendon of the external Oblique is fixed by oblique Fibres in the Linea Alba through its whole Length, mixing with thofe that come from the fame Mufcle on the other Side.

Thefe tendinous Fibres are likewife continued a great way beyond the Linea Alba through the Tendon of the other Mufcle, and this Intertexture is reciprocal. Thofe who look upon the flefhy Part of this Mufcle as its Beginning, call it Obliquus Defcendens, and it has likewife been named Obliquus Superior and Obliquus Major.

Obliquus Internus, or Defcendens, is a broad thin Mufcle like the former, having nearly the fame Extent and Infertions, that is, in the inferior Ribs above; in the Crifta of the Os Ilium, and Ligamentum Fallopii, below; and in the Linea Alba, before; but it differs from it in this, that its inferior Part is more flefhy than the fuperior.

One Portion of its inferior Extremity, which is entirely flefhy, is fixed by very fhort tendinous Fibres in the middle Space between the two Labia of the Crifta Offa Ilium, from the Pofterior of the Tuberofity of that Crifta near the Symphyfis of the Os Sacrum, almoft all the way to the fuperior and anterior Spine of the Os Ilium; fo that its Infertion reaches further back than that of the external Oblique.

The flefhy Fibres thus fixed, afcend firft a little obliquely from behind forward, and then this Obliquity increafes proportionably as the Fibres lie more anteriorly, and they crofs thofe of the flefhy Portion of the external Oblique, being afterwards inferted exteriorly in the inferior Margins of the Cartilages of all the falfe Ribs, and thofe of the

two

two loweſt true Ribs, reaching to the Extremity of the Cartilago Enſiformis.

Theſe Inſertions form fleſhy Digitations at the Extremity of the loweſt falſe Rib, at the oſſeous Extremity of the fourth, and through all its Cartilage, and at the middle Portion of the Cartilage of the third. Here the Inſertions become tendinous, and an Aponeuroſis is formed, which, from the ſecond falſe Rib anteriorly, is divided into two Laminæ by which the Muſculus Rectus is incloſed.

The other Portion of the inferior Extremity of this Muſcle, continuous with the former, is fixed to the anterior Extremity of the Criſta of the Os Illium, to its anterior and ſuperior Spine, and to that Part of the Ligamentum Falloppii which lies neareſt it. From all this Inſertion, the Fibres expand like Raddii through the whole Extent of the Linea Alba. Thoſe from the Criſta deſcend ſuperiorly toward the Linea Alba, and afterwards they gradually change their Direction, till at length they become almoſt perpendicular to that Line. Thoſe that come from the Spine and Ligamentum Fallopii, are gradually bent downward, and are inſerted partly in the Spine, partly in the Symphy-of the Os Pubis, being inſeparably mixed with the inferior Margin of the Aponeuroſis of the external Oblique.

This anterior or radiated Portion being at its Beginning wholly fleſhy, becomes afterwards entirely tendinous, and together with the Tendon of the other Portion, forms an Aponeuroſis like that of the external Oblique, the Extremities of all the fleſhy Fibres forming an oblique Line a little bent from above downward, beginning at the third falſe Rib, and reaching to the Ligamentum Fallopii.

The Aponeuroſis of the internal Oblique thus formed, is afterwards divided into two Laminæ, from

from the Extremity of the ſecond falſe Rib, to its inferior Margin; and having by this Diviſion furniſhed a Vagina to the Muſculus Rectus and Pyramidalis of the ſame Side, the two Laminæ unite again at the Linea Alba, being interwoven with thoſe belonging to the Muſcle on the other Side, and mixed with the Aponeuroſis of the External Oblique in a very ſingular Manner. This Aponeuroſis is every where cloſely connected to that of the external Oblique, and the Vagina of the Rectus ſeems to be ſtronger above the Umbilicus than below it, and nearer the inferior Extremity of the Linea Alba becomes ſo thin, that the Rectus and Pyramidalis may be ſeen through it.

In the Paſſage between the anterior and ſuperior Spine of the Os Ilium, and Os Pubis, at ſome Diſtance above and behind the tendinous Opening or Ring of the external Oblique; the fleſhy Fibres at the inferior Margin of the internal Oblique, leave a Paſſage for the Spermatic Veſſels in Men, and for the Vaſcular Ligament commonly called the round Ligaments in Females. This Paſſage is near the Place where this Muſcle connects the Aponeuroſis of the former; and though it appears in ſome Subjects to be formed by a real Separation of the fleſhy Fibres, in others it lies between the fleſhy Margin of this Muſcle and the Inſertion of the Obliquus Externus in the Ligamentum Fallopii. In this Courſe a Faſciculus of fleſhy Fibres is likewiſe detached from this Muſcle, which contributes to the Formation of a ſmall Muſcle called Cremaſter.

There is moreover a thin Plane or Series of fleſhy Fibres between the poſterior Part of this Muſcle, and the Aponeuroſis of the Muſculus Tranſverſalis, which covers the Quadratus Lumborum, and ſeems to be fixed by a broad Aponeuroſis to the Ligament which goes between the laſt

Lumbar

Lumbar Vertebra and to the Tubercle of the Crifta Offis Ilium. From thence it afcends obliquely forward, and contracting in Breadth, is fixed in the Extremity of the laft falfe Rib. Therefore if this Series be reckoned a Part of the internal Oblique, this Mufcle muft be faid to be inferted not only in the Crifta of the Os Illium, but alfo in the laft Lumbar Vertebra, by means of the Ligament already mentioned.

This Mufcle is likewife called Obliquus Defcendens, for the fame Reafon that the former is termed Afcendens; Obliquus Inferior and Obliquus Minor, becaufe it does not reach fo high, and is not quite fo large as the external Oblique.

Musculi Recti. They are narrow Mufcles, thicker than the Obliqui, and lie near each other like two large Bands, from the lower Part of the Thorax to the Os Pubis, the Linea Alba coming between them. Their Breadth diminifhes, and their Thicknefs increafes gradually from above and downward.

The fuperior Extremity of each Mufcle is fixed to a Part of the inferior Extremity of the Sternum to the three loweft true Ribs, and to the firft falfe Rib, by the fame Number of Digitations, of which that which is furtheft from the Sternum is the broadeft.

The Subftance of the Mufcle lies in the Vagina, formed by the Aponeurofis of the broad Mufcles of the Abdomen. Exteriorly it is divided into feveral Portions refembling diftinct Mufcles placed endways, by tranfverfe Tendons termed Enervations, which commonly are all above the Umbilicus, very feldom below it, and they adhere very clofe to the Vagina.

Thefe Infertions are pretty irregular. They do not always penetrate the whole Thicknefs of the Mufcle; and in that Cafe they do not at all appear,

pear, or but very little, on the interior Surface. Sometimes thofe which are feen on the exterior Surface do not run quite crofs the whole Breadth of the Mufcle.

The inferior Extremity of this Mufcle is narrower than the fuperior, and ends in a thin Tendon fixed in the internal Labium of the fuperior Margin of the Os Pubis near the Symphyfis, and there it touches the Tendon of the other Rectus.

Above the Umbilicus, thefe two Mufcles are at fome Diftance from each other, according to the Breadth of the Linea Alba; but below it they come nearer, the Linea Alba being there narrower, and near their inferior Extremity that Line is almoft entirely hid by their thick Margins.

Musculi Pyramidales. At the inferior Part of the Recti we meet commonly with two fmall Mufcles, which at firft feem to be a Portion or Appendix of the former. They are named Pyramidales from their Figure, and by Fallopius Succenturiati.

At the inferior Extremity they are broad and thick, being there fixed to the fuperior Margin of the Offa Pubis, immediately before the Recti. They decreafe gradually in Breadth and Thicknefs as they afcend, and end by a Point in the Linea Alba, a little Diftance below the Umbilicus.

They are partly inclofed within the Vagina of of the Recti, running clofe by each other along the Linea Alba, to which they are fixed at different Diftances by oblique tendinous Indentations, the fuperior Extremities of which are fometimes very long.

Sometimes thefe Mufcles are wanting, and then the inferior Extremities of the Recti are thicker than ufual. Sometimes there is only one Pyramidalis; and fometimes they are not both of the

fome

ſome Size and Length. We very rarely meet with three in one Subject *.

TRANSVERSALES. They are nearly of the ſame Breadth with the Obliques. Their Name is taken alſo from the Direction of their Fibres, and each of them is fixed to the Ribs, above; below, to the Os Ilium and Ligamentum Fallopii; before, to the Linea Alba; and behind, to the Vertebræ.

The ſuperior Part of this Muſcle is fixed to the inferior Part of the interior Surface of the Cartilages of the two loweſt true Ribs, by fleſhy Digitations, the Fibres of which run more or leſs tranſverſly toward the Linea Alba, at ſome diſtance from which they become tendinous. Theſe Digitations meet, and exactly correſpond with thoſe of the Diaphragm, but never mix with them in the human Body.

The middle Part is fixed to the three firſt lumbar Vertebræ by a double Aponeuroſis or two tendinous Planes, one internal or anterior, the other external or poſterior. The internal is inſerted in the tranſverſe Apophyſes, the external in the ſpinal Apophyſes and interſpinal Ligaments, being cloſely united to the tendinous Expanſions of the circumjacent Muſcles; and the external Laminæ of both Tranſverſales appear to be continuous, their common Inſertion in the ſpinal Apophyſes by no means hindering them from ſliding like a Girth, towards either Side on the Proceſſes juſt mentioned.

The internal and external Planes having incloſed in their Duplicature, the muſculus Sacro-Lumbaris and Quadratus Lumborum unite in one ſtrong Aponeuroſis at the Margins of theſe Muſcles. From this Aponeuroſis ariſes the middle and great-

* I have met with theſe Muſcles in old Women, one of which reached almoſt to the Navel.

eſt Part of the fleſhy Portion of the Tranſverſalis, which, together with the ſuperior Part, advances toward the Linea Alba, and at ſome Diſtance from it, becomes tendinous.

The inferior Part of this Muſcle is fixed by an Inſertion entirely fleſhy to the internal Labium of the Criſta Oſſis Ilium, and to a great part of the Ligamentum Fallopii. From thence many of Fibres run towards the Linea Alba, the reſt to the Os Pubis, all of them becoming more or leſs tendinous before their Inſertion.

It is commonly ſaid that there is a Separation in the fleſhy Fibres of this Portion behind that ſuppoſed to be in the internal Oblique, for the Paſſage of the ſpermatic Veſſels, &c. There is indeed a Sort of Aperture, but it is ſo very near the internal Oblique, as to make it very doubtful at firſt Sight, whether it be formed by a Separation of the Fibres of the Tranſverſalis, or lies between the fleſhy Margins of that Muſcle, and of the obliquus Internus, which, after a careful Examination, appears to be the Eaſe.

This Proximity makes it no eaſy Matter for many Anatomiſts to determine whether the fleſhy Fibres, of which the Cremaſter Muſcle partly conſiſts, belong entirely to the internal Oblique, or whether ſome of them do not likewiſe come from the Tranſverſalis, as others do from the Ligamentum Fallopii.

The middle Part of the fleſhy Plane of this Muſcle ends in a very broad Aponeuroſis cloſely adhering to that of the Obliquus Internus, the Vagina or Duplicature of which it ſtrengthens interiorly, as that of the external Oblique does exteriorly. Afterwards this Aponeuroſis reaches the Linea Alba, and joins that of the other Tranſverſalis by a particular Sort of Intertexture, without mixing either with the internal Oblique, or with the

the Peritonæum. The whole Aponeurofis of the three Parts of this Mufcle, from the flefhy Fibres to the Linea Alba, reprefents a Kind of Crefcent, and it was for this Reafon that the Ancients have faid that it terminated anteriorly in a femilunar Line.

The common Ufes are to fuftain the Vifcera of the Abdomen, and to counterbalance the perpetual Motions of ordinary Refpiration, and thereby gently and continually to act on the Vifcera; which Action may be reckoned a Sort of Trituration, of great Importance to the Animal Oeconomy. They comprefs the Abdomen in order to clear it of what ought to pafs off by the natural Outlets, to relieve the Stomach by Vomiting, from whatever might be hurtful to it; and laftly to drive out by a violent Expiration whatever may incommode the Organs contained in the Thorax.

Thefe two kinds of Motion are carefully to be diftinguifhed. The firft is purely mechanical, and in a manner paffive; the other is arbitrary and really active.

In the firft, the Vifcera, preffed by the Diaphragm in Infpiration, force thefe extertal Mufcles on all Sides, overcoming their natural Elafticity; but the Diaphragm being relaxed in Expiration, and yielding to the Vifcera, they recover themfelves again. In the fecond, thefe Mufcles really act, that is their flefhy Fibres are contracted and fhortened, and thereby they comprefs the Vifcera, efpecially the Stomach and Inteftines, forcing out by the neareft Paffages whatever is capable of Expulfion.

In this latter Cafe the Diaphragm acts while the Abdominal Mufcles are in Contraction, and thereby concurs in an univerfal Compreffion of the Belly; but in the firft Cafe it does not act, as fhall be fully fhewn hereafter.

The particular Diſpoſition of the fleſhy tendinous Portions of the Obliqui and Tranſverſales, renders this Compreſſion uniform, and thereby the Muſcles reſiſt the Force of the compreſſed Viſcera, almoſt equally on all Sides.

The Muſculi Recti ſerve to ſupport the Trunk of the Body when inclined poſteriorly, and to bend or bring it anteriorly again; to raiſe the Body up when lying; and laſtly, to climb. They ſerve, I ſay, to bend the Trunk when inclined backward or laid down; for when we ſtand ſtrait, they have no Hand in bending the Body forward, except we be ſtriving to overcome ſome Reſiſtance. The Weight of the Thorax, Head, and ſuperior Extremities, joined to the determinate Relaxation of the poſterior Muſcles of the Back and Loins, produce this Effect in all other Caſes, as has been already mentioned in the general Obſervations on the Action of the Muſcles.

Winslow is not as yet convinced that the Recti can contribute any thing to the arbitrary Compreſſion of the Abdomen, which has been already mentioned as one common Uſe of all theſe Muſcles.

The Pyramidales ſeem only to aſſiſt the Action of the Recti; though when we conſider the oblique Direction of their Fibres toward the Linea Alba, there may be ſome Reaſon to think that they compreſs the Bladder, eſpecially when very full of Urine, as Fallopius has remarked. The lower Portions of the internal Obliques and Tranſverſales may perhaps contribute ſomething to this Effect; for when contracted, they form a flat tight Kind of Girth, by the Middle of which the ſuperior Extremities of the Pyramidales are kept immoveable, while their Bodies being ſhortened and flattened by contracting, preſs upon the Bladder.

The oblique Muſcles are capable of acting by diſtinct Portions. Their poſterior Portions have

The

nearly the fame Ufes on each Side as the Recti have before; that is, they ferve to fupport the Trunk on one Side when it is inclined to the other; to bend the Body to that Side on which they lie, and to raife one Side of the Pelvis or Hip, while the other is well fupported.

The fuperior and anterior Portions of the external Oblique of one Side, ferve to turn the Thorax upon the Pelvis as upon a Pivot, the Pelvis remaining fixed and immoveable by fitting. This Motion may be termed the Rotation of the Thorax on the Pelvis.

When we ftand and turn the Thorax to each Side in the fame manner, this Motion is not at firft the Rotation already mentioned; for the Feet remaining then fixed, the Legs and Thighs turn to one Side and carry the Pelvis along with them; but this Motion being carried as far is poffible, and the Pelvis being confequently in a Manner fixed, the Rotation of the Thorax then takes Place, by Means of the two oppofite oblique Mufcles in the Manner already faid.

When all the Portions of thefe four Mufcles act together, they may affift the Recti in great Efforts; as for Inftance, when with the Arm or Thorax we pufh forward a very heavy Body, or drag it after us.

The Tranfverfales feem to have no other Ufe than that of bracing or girding the Abdomen in different Portions thereof, and thefe again may gradually fucceed each other. For Inftance, the fuperior Portion may contract feparately, while the inferior Portion is totally relaxed, as I have often obferved in myfelf.

There are ftill other Ufes belonging to thefe Mufcles, but they cannot be intelligibly explained till feveral others have been defcribed.

Observation on the Connexion of the Obliqui and Transversales.

Thefe three Mufcles are not only united by their inferior Margins, and inferted together in the Ligamentum Fallopii, but alfo braced by the Adhefion of the Fafcia Lata to that Ligament, and by the Connection of its ligamentary Fibres with the Tendon of the external Oblique. This Place is commonly called the tendinous Arch of the Mufcles of the Abdomen, becaufe it appears in this Shape when the Fafcia Lata is removed. This Connexion is ftrengthened by a very thin Expanfion of tendinous Filaments which decuffate the Aponeurofis of the Obliquus Externus, and reaching all the Way to the Fiffure, ftrengthen the fuperior Margin thereof in the Manner already faid.

When this tendinous Expanfion is feparated from the Aponeurofis of the External Oblique, in young Subjects and in Women the Apertures do not any more appear like a Ring, but fimply as a void Space left by the Separation of the tendinous Fibres. This Expanfion feems to be formed by a Continuation partly of the tendinous Fibres of the Obliquus Externus, and partly of thofe of the Fafcia Lata.

The two oblique Mufcles and the Tranfverfalis of each Side, are difpofed in a very fingular Manner, with relation to their flefhy and tendinous Portions; for the Tendons of fome of them anfwer to the flefhy Parts of the reft. The external Oblique is moft tendinous in the inferior Part and moft flefhy in the Superior. The internal Oblique is moft tendinous in the fuperior Part, and moft flefhy in the inferior. The Tranfverfalis is moft tendinous in the Middle and moft flefhy in the fuperior

perior and inferior Parts. By this Disposition these three Muscles compose nearly an uniform Plane, the fleshy and tendinous Fibres being equally distributed through all its Parts.

It is commonly said that the Linea Alba is only the Concourse or Place where these three Pairs of Muscles meet; but if we examine well, we find there an Intermixture not easy to be unravelled. One Portion of the external Oblique of one Side seems to be continued with a Portion of the internal Oblique of the opposite Side, these four Portions making only two digastric Muscles, which cross each other obliquely. In the same Manner, the two Transversales by the Union of their Aponeurosis, from a third digastric Muscle; so that we have here three broad Fasciæ or Spansions very artfully crossing one another, formed indeed not by the whole Muscles, but only by the middle Portions of them.

The Linea Alba is perforated by a small round Foramen near the Middle of its Length; the Circumference of which is formed by tendinous Fibres, twisted and interwoven in such a Manner, as to produce a regular and perfectly round Border. Before Birth, this Hole transmits the Funis Umbilicalis, and then it is pretty large; but in Adults it is very much contracted.

LECTURE XVIII.

Of the NATURE of the BLOOD of the HUMAN BODY.

THE very complex Liquor, which is contained in the beating Arteries and their correſponding Veins, is called by one general Name, the Blood, which, to a looſe Examination, appears homogeneous, or of ſimilar Parts, red and coagulating throughout. But Experiments of divers Kinds have ſhewn us, that diſſimular Parts of various Natures reſide in the Compoſition of this animal Liquor.

Hydroſtatical Experiments demonſtrate in the Blood, firſt a Kind of volatile Vapour or Exhalation, which immediately and continually flies off from the warm Juices with a Sort of fœtid Odour coming betwixt that of the Sweat and Urine; this Vapour, being catched and condenſed in proper Veſſels, appears of a watery Nature, joined with a ſmall Tincture of an alkaline Diſpoſition.

This Halitus of the Blood conſiſts of an ammoniacal Salt, ſo attenuated as to be volatile, without altering its Nature much to the alkaline Claſs, which, joined with a ſmall Portion of Oil and much Water, affords that remarkable nedorous Smell upon opening a Dog, Hog, or other carnivorous Animal whilſt warm, for in Oxen, Sheep, Calves, &c.

&c. feeding on Grafs, or Grain, it hath fcarce any perceptible Smell; but in Mankind, it has a very particular Odour, flying off chiefly in the Perfpiration, by the Scent of which every Dog can diftinguifh and follow the Foot Steps of his Mafter.

After this Vapour is gone off, the Blood of a healthy Perfon fpontaneoufly congeals into a folid trembling Mafs, and with a lefs Degree of Heat than that of boiling Water, (viz. 150. gr. i. e. 62. lefs than boiling Water) it grows more tough like to a boiled Egg. But even within the Veffels of a living Perfon, dying of a Fever, the Blood has been feen by the Violence of that Diftemper, changed into a concreted tremulous Jelly throughout all the Veins. The principal Part of this coagulated Mafs, is the Craffamentum or Cruor, which has the red Colour peculiar to itfelf, and gives it to the other Part of the Blood. This, if it be not kept fluid by the Attrition of a vital Circulation, or fome fimilar Concuffion, runs confufedly into a compact, but foft Mafs, merely by Reft and a moderate Degree of Cold, as it alfo does by the Addition of Alcohol, by mineral Acids, or by a Heat of 150 Degrees, (of which 98 is the Blood's Heat in robuft People; 175 boil Alcohol Vini; 190 boil proof Brandy; and 212 boil Spring Water.) 'Tis either as a Fluid or Solid fpecifically heavy, and more fo than Water, by near an eleventh Part; and when freed from its Water, it is wholly inflammable. In a Mafs of healthy Blood, one Half or upwards of its red Cruor; and in ftrong laborious People the Serum makes only a third Part, and is ftill more diminifhed in Fevers, often to a fourth or fifth Part of the Mafs.

Next to this comes the white or clear, and the yellowifh Part of the Blood, which again feems to

be a Liquor, consisting of homogeneous or similar Parts, when it is not so. This Serum (as it is called) of the Blood, is in general, one thirty-eighth Part heavier than Water, and almost a twelfth Part lighter than the red Mass of Crassamentum; this too, by a Heat of an hundred and fifty gr. or by Mixture of mineral Acids or Alcohol, and by a concussive Motion is congealable into a much harder Coagulum than the red Cruor, or mixed Mass; and forms an undissolvable Glue, a Flesh like Membrane, which at length shrinks up to a Horn-like Substance. From thence are formed the pleuritic Crusts or Skins, Polypusses and artificial Membranes. In this Serum of the Blood besides the Albumen, which will harden like the White of an Egg, there is concealed a great deal of simple Water, which even makes the greater Part of the whole, and some Quantity of ropy Mucus drawing out into long Filaments like Spiders Threads; which last, however, is not coagulable like the Albumen, neither by Fire nor by Acids.

But by Putrefaction only, or the dissolving Power of the Air, hot to 96. gr. equal to the Blood's natural Heat, the whole Mass, but especially the Serum dissolves or melts into a fœtid Liquor, first, the Serum, and then the Cruor more slowly; till, at length, the whole Mass both of Serum and Cruor, are turned into a volatile and fœtid Exhalation, leaving very few Fæces behind. When the Blood has been once dissolved by Putrefaction there is no Artifice can harden or congeal it; as there is none likewise that can resolve it again, after it has been once coagulated by Spirits of Wine. The natural gelatinous Density and Cohesion of the Blood is dissolved in malignant and contagious Fevers.

Besides

Besides these Parts of which the Blood appears to consist, without subjecting it to any Violence, it contains in its Substance a Quantity of Sea Salt, which is discernable to the Taste, and sometimes visible by the Microscope. The fine chalky Earth loged in the Blood, is demonstrated from its affording the Matter of Nutrition and from a chymical Analysis, whereby it appears to lodge in the most fluid Parts of it, and is more especially intimately combined in great Plenty in the oily Parts of the Blood. Another Part in the Blood is Air, in an unelastic State, and that in a very considerable Quantity, (to the Weight of half a Scruple in an Ounce) the Existence of which Air, in the Blood and Serum, is proved by their Putrefaction and Distilation, or by removing the ambient Air from them by the Pump. But we are not to think hence, that the Blood Globules are Bubbles full of Air, for they are specifically heavier than the Serum, and make no Dilatation, by taking off the Pressure of the Atmosphere from them by the Pump. (Lastly it appears from late Experiments, that the Caput Mortuum, or Ashes of the Blood are replete, with a Sort of Iron, which the Load Stone will attract; and which being found also in the Ashes of Vegetables, as well as Animals, and in most earthy Bodies, is therefore by some, reckoned an Element or constituent Principle of Bodies.)

Among other Bodies, Chymistry has various Ways endeavoured to show us the Nature and Principles of the Blood; which being fresh drawn, and distilled with a slow Heat, (gr. 212, or below boiling Water) yields a Water to the Quantity of five Parts in six of the whole Mass, which Water has little or no Taste or Smell, till you come towards the End of the Operation, when it is pro-

portionably more charged with a fœtid Oil, as it draws nearer to a Conclusion. What remains after you have drawn off this Water, being exposed to a stronger Fire, yields various alkaline Liquors, of which the first being acrid, fœtid, and of a redish Colour, is usually called the Spirit of Blood, consisting of a volatile Salt, with some little Oil, dissolved in Water, to the Amount of one fifteenth Part of the whole original Mass of Blood. A little before and together with the Oil, that next ascends in the Distillation, a dry volatile Salt arises and adheres in the branchy Fleeces to the Neck and Sides of the Glasses; and this in but a small Proportion, less then an eighteenth Part of the first Mass. The next Liquor is that called Oil of human Blood, which ascends gradually thicker and heavier, at first yellow, and afterwards darker to a black, till at last it resembles Pitch; being very acrid and inflammable, but in a small Quantity, about a fifteenth of the whole Mass. What remains of the Blood, in the Bottom of the Retort, is a very spongy inflammable Coal or Cinder, which, being kindled, burns away and leaves Ashes behind; which being dissolved into Lixivium with Water, affords a mixed Salt, partly Sea and partly fixed Alkali, leaving a mere dead Earth in the Filter. This fixed Salt is scarce the five hundredth Part of the first Mass, and has in itself only one fourth Part alkaline: But being urged with the most intense Degree of Fire, the whole Salt affords some Portion of an acid Spirit; which we judge to arise partly from the Marine Salt in the Blood, some of which is demonstrable even in the Spirit of Blood, and partly from the vegetable Kind of the Aliments, not yet digested into an animal Nature. For which last Reason, an Acid is procurable from the Blood of herbivorous Animals, as well as from that

that of Man. But the Earth ſeparated from the Lixivium by Filtration, will, perhaps, make about the one hundred and fiftieth Part of the original Maſs, and contains ſome Particles which are attracted by the Load Stone. The Serum only of the Blood, by Diſtillation, alſo affords altogether the ſame Principles, only the Water is more abundant, as the Oil and Earth are in a leſs Proportion.

From the preceding Analyſis of the Blood, it evidently contains a Variety of Particles, differing in Bulk, Weight, Figure, and Tenacity, ſome watery, others inflammable, and moſt of them inclined greatly to Putrefaction, or to an alkaline corroding State. For the Blood in a ſound healthy State, not injured by Putrefaction, or too violent a Degree of Heat, is neither alkaline nor acid, but mild or gelatinous, and a little ſaltiſh to the Taſte, yet in ſome Diſeaſes it is ſharp enough, and comes to a State of Putrefaction; as for Inſtance, in the Scurvy, where it corrodes through its containing Veſſels, and in thoſe who have an Aſcites or Dropſy, whoſe Waters are often much of a corroding and alkaline Nature; but that which is as Blood in Inſects affords a ſharp alkaline Calx, effervеſcing with Acids. If human Blood be mixed with Alcohol or ſtrong mineral Acids, it runs into a Coagulum; but by the milder vegetable Acids, Verjuice, Vinegar, Lime Juice, &c. and alſo by alkaline Salts, fixed or volatile, but eſpecially the laſt, and by Nitre or all neutral Salts, it continues or even re aſſumes its firſt Fluidity. There is no Salt with which the Blood makes any Effervеſcence; violent Exerciſe, too long continued with too great external Heat, ſoon diſſolve the Blood into a putrid State, even within the Veſſels of a living Perſon.

Laſtly, by viewing freſh Blood in a ſmall Glaſs Tube, by a Microſcope, or by inſpecting it by the ſame

ſame optical Inſtrument while it is yet moving in the Veins of the living Animal, we diſtinguiſh its ſoft red Globules, which are elaſtic, ſo as to be able to change and recover their Figure, and which doubtleſs, make the Part called Cruor or Craſſamentum of the Blood. (If it be queſtioned, whether theſe are not rather oleaginous lenticular Particles of the ſame Kind as thoſe obſerved by LEWENHOECK in Fiſh, and lately diſcovered in our own Species; we confeſs it is a Point difficult to determine; but the ready and frequent Diviſion of Oil or Fat into Globules by Concuſſion ſeems to countenance ſuch an Opinion.)

Thoſe red Globules we ſee ſwimming in a thinner Liquor, in which, by the ſame Microſcope, we alſo diſtinguiſh leſſer yellow Globules; and obſerve that the red ones diſſolve into ſimilar yellow, or ſmaller Globules by Reſt and Warmth. The Diameter of the red Globules is, by the moſt accurate Experimentors in this Way, computed at $\frac{1}{3240}$ an Inch.

The pellucid Water remaining, in which the former Globules were obſerved to ſwim, does yet, by the finer Microſcopes, appear to contain ſtill ſmaller Globules, of an aqueous Clearneſs, with various Spicula of Salts.

From the preceding Experiments compared together ariſes that Knowledge which we at preſent have of the Blood; namely, that the Craſſamentum or Cruor is compoſed of Globules, which, being forced together by the coagulating Cauſes, which increaſe their Attraction of Coheſion, harden into a confuſed ſolid Maſs. The inflammable or combuſtible Nature of the ſaid Globules is proved from dried Blood, which takes Flame and burns, as alſo from the Phoſphorus, or rather Pyrophorus, (ſince it not only ſhines but generates com-

combuftible Fire) which is diftilled from human Blood; and from thefe probably arifes the greateft Part of the pitchy Oil that is obtained from Blood by the Violence of Fire. But actual Filaments, there are none naturally in the Blood; though they be made in it by the Addition of cold Water.

The yellow Serum of the Blood appears likewife to confift of leffer Globules fwimming in Water; and in what we defcribed before, in the watery or thinner Liquor of the Serum, whofe Particles are not vifible to the Eye; there are contained the fame Principles with a Portion of Water, as was fhewn in the Blood itfelf, of which the Force of Fire makes alkaline Salts. In proof of this, we may alledge a Diftillation of the Saliva or Mucus with the Nature of the perfpiring Matter of Sanctorius.

The exact Mafs or Quantity of Blood, contained in the whole Body, cannot be certainly computed, yet we know in general that the Mafs of Humours is much greater than that of the Solids; only we are to confider, that many of them do not flow currently in the Circulation, as the Glue or Jelly that lodges in moft Parts, and the Fat. But if we may be allowed to form a Judgment from thefe profufe Hœmorrhages that have been fuftained without deftroying the Life of the Patient, with Experiments made on living Animals, by drawing out all their Blood, joined with the Bulk of the Arteries and Veins themfelves; from thefe Principles, the Mafs of circulating Humours will be at leaft fifty Pounds, whereof near a fifth Part will be true red Blood current in the Arteries and Veins, of which the Arteries contain only one fifth, and the Veins the other four.

Nor does the Blood always contain the fame, or a like Proportion of thofe Elements or Principles, which we have before defcribed in it: For an increafed

creased Celerity, whether by laborious and strong Exercises and a full Age, (from 30 to 40) Fever or otherwise, augments the Crassamentum with the Redness and congealing Force and Cohesion of Particles; and the Hardness and Weight of the concreted Serum, with the alkaline Principles are, by the same Means, increased; on the other Hand, the Serum and the Mucus it contains are increased by the contrary Causes the more as the Animal is younger, less active, or exercised, and fed more on a watery, vegetable Diet; by all which the Crassamentum of the Blood is lessened, and its watery Part increased. Old Age again lessens the Crassamentum, and the gelatinous Part likewise.

From these Principles, but with a conjunct Consideration of the solid Fibres and Vessels, ('Tis a wise Caution of HALLER not to make any Deductions, physiological or therapeutical, unless the conjunct State of the Solids enters the Consideration. The Quantity or Quality of the Blood vitiated or offending are not the primary Causes of slow Diseases, but the Effects of a vitiated State of the Solids, and their Actions by which the Blood and all other Juices are moulded or composed, and to the State of which their Quantity and Quality are answerable; and for this Reason, all learned Professors have proposed the Consideration of the elastic moving Fibres and Vessels, as the necessary Foundation to a Knowledge and Cure of Diseases,) the different Temperaments and morbid Constitutions of People are derived. For a plethoric or sanguine Habit arises from an Abundance of the red Globules. A phlegmatic Temperature is from a Redundancy of the watery Parts of the Blood. A choleric Disposition of the Humours seems to arise from a greater Acrimony and Alcalescence of the Blood, as appears from those who

who live on Flefh and on the human Species; being fo much fiercer and paffionate than thofe who live on Plants, or on vegetable Food. As for the Melancholy, if there is really fuch a Humour in the Blood, it feems to confift in a Redundancy of the earthy Principle. (With Refpect to the folid Parts a greater Firmnefs joined with a more exquifite Senfibility or nervous Irritability, difpofe to a choleric Habit, and a lefs Irritability with a moderate Denfity, to a fanguine Habit, and a leffer Degree both of Denfity and Irritability are to be referred to a phlegmatic Temperament. In the Melancholy again, a Weaknefs of the Solids is joined with the higheft Degree of nervous Irritation or Senfibility.) But you muft be careful not to make thefe Temperaments as the fole and limited Syftems or Claffes of Conftitutions; which, in the Courfe of Nature, are found to be not only four, eight, or even thirty two; but are really diftinct in numberlefs Degrees.

The red Parts of the Blood feem chiefly of Ufe to generate Heat, fince they always abound in Proportion to the natural Heat of the Animal. Thefe being confined by the Largenefs of the Globules, within the red and firft Order of Veffels, hinders the Collapfion of their Extremities, and in receiving the common Motion of the Heat, by the great Denfity of their Parts, they hold the Motion longer, or make a greater Impetus and Attrition upon the leffer Orders of Humours, upon which their Motion is impreffed. And hence it is, that the red Part of the Blood, being too much diminifhed by profufe Bleedings, there follows a Stagnation, or leffened Motion of the Humours in the fmaller Veffels, whence Fatnefs, Coldnefs, Dropfy, &c. By the fame Rule alfo, a due Proportion of the faid red Blood is neceffary within the Habit, to

generate

generate and repair new Blood for the Ufes of the whole Syftem; for by large Hæmorrhages we fee the Blood lofes its red or denfe Nature and degenerates into a pale ferous, or watery State.

The hardening Serum is more efpecially defigned for the Secretions and Nutritions of the Parts, as will be hereafter more apparent. The thinner Juices then fecreted have various Purpofes, as the Diffolution of the Aliments, the Moiftening of the external Surface of the Body and Surfaces of the internal Cavities, to preferve the Flexibility of the Solids, and conduce to the Motion of the Nerves, the Sight, &c.

Therefore Health cannot fubfift with a denfe and red Blood, whofe Quantity too much diminifhed caufes a Stagnation or flow ropy trailing of the Juices within the Veffels, whence Cachexy or Palenefs, Coldnefs, Weaknefs or the like: For on the other Hand can Life or its proper Offices be carried on, or Health fubfift without a Sufficiency of thinner Juices intermixed with the red Blood; which being deprived of its watery Part, congeals and obftructs the fmalleft Paffages of the Veffels, and kindles to a great Heat.

If it be afked whether there be any Difference betwixt the arterial and venal Blood, we anfwer, that fome Difference there feems to be, the former having lately paffed the Action of the Lungs. But in Experiments, I fcarce find any obfervable Difference either in Colour, Denfity, or any other known Diverfity; for the Circulation is very quick, and the venal Blood itfelf was but a little before arterial. (However the venal Blood is apparently of a more bright or fplendid red, and having a greater Degree of Fluidity and Proportion of watery Parts, may fo far differ from the venal darker coloured

loured Blood. But, in this Refpect, it remains that we make further Experiments.)

From one and the fame Mafs of Blood, driven into the Aorta, are generated all the Juices or Humours of the human Body, which, from their Obliquity one to another, are reducible to certain Claffes following; but the Manner or Artifice by which each of them are feparated, ought to be accounted for by the Fabric or Mechanifm of the Glands themfelves. HALLER Linea Prim. Phyf.

As the Blood runs quicker, and into Co-mixture in the Veins, as it comes nearer the Heart, fo its Particles move more flowly towards a Separation in the Arteries, as they get farther from the Heart with a diminifhed Impulfe. Thus the Motion of the Blood in the arterial and venal Veffels may be, in general, compared to a Body afcending perpendicularly, contrary to the Force of Gravity, by fome Impulfe, and with a Momentum or Celerity continually leffening, and then returning or defcending with a Celerity perpetually increafing; only in the Blood, this Retardation and Acceleration are neither made uniformly, nor in any certain or regular Proportion, with Refpect to the Diftances from the Heart, becaufe the Diverfity of Strength, Ramification, Convolution, &c. of the Veffels themfelves, in which it moves, is irregular and unlimited.

OBSERVATIONS.

We fee hence, that too much or too little Motion of the Blood will, either of them, caufe a morbid Acrimony; the firft in a little Time, as in Fevers; and the laft in a longer Time, as in Cachexies, Scurveys, &c. In the Feavers, which begin without any diffolving Contagion, as well as in too much or long continued hard Labour, the

Blood

Blood runs on from the Beginning toward the Height, through various Degrees of inflammatory Tenacity, i. e. to ſay, the more thin and aqueous Part being gradually thrown out by the fluid Secretions, the nutritious Albumen or Glue, in the Blood, which forms a ſort of Cruſt round the Surface of each Globule, becomes ſo thick and tenacious, that they join more ſtrongly together into Coheſions, unleſs kept under by Motion; but the ſame Degree of Motion or Impetus will make thoſe Globules keep changing their Points of Contact longer, which have the greater Denſity, i. e. the red ones, conſequently the ſmall pellucid Globules will, in this Caſe, from their leſs motive Power, and from their greater Surface, which augment the Attraction of Coheſion, firſt run into filamentary Concatinations; for when the Attraction of Coheſion is increaſed to a certain Degree, their ſpherical Figure will, in all Points of Contact, be depreſſed like fattened Cakes, and that more or leſs in various Degrees, proportionably to the fewer ſaline, watery, &c. Particles, which interpoſe and prevent their cloſer Coheſion. This will account both for the Production, Increaſe, and Degrees of Toughneſs in the Pleuritic inflammatory Cruſt of the Blood, which is even an Attendant, more or leſs, upon an accelerated Circulation through the whole Syſtem, or only ſome particular Part, from Pain particularly provided, there is at the ſame Time, no ſaline, putrid, or diſſolving Acrimony in the Maſs.

The End of the firſt VOLUME.